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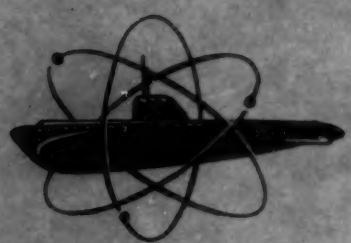
POWER INDUSTRY

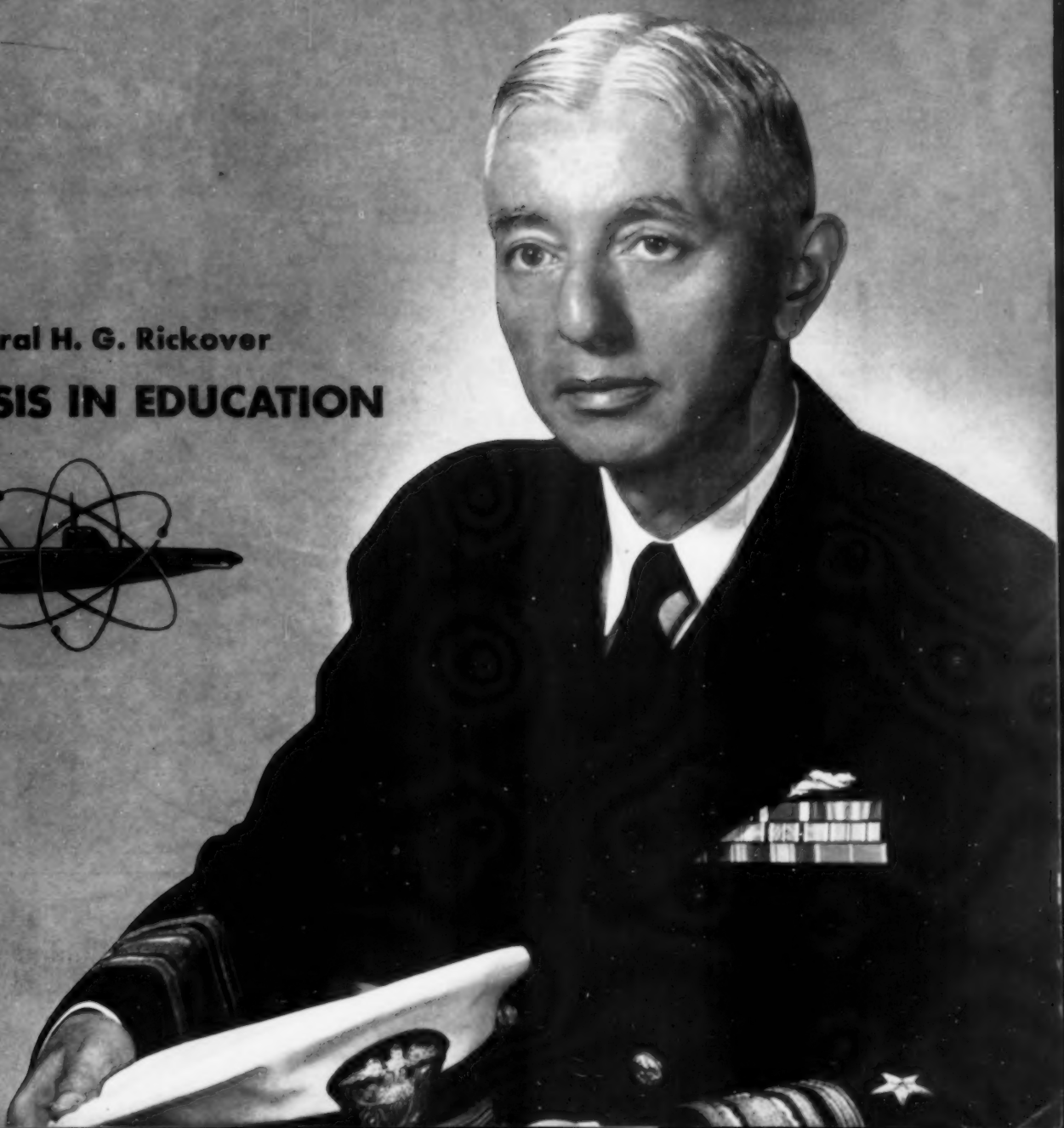
Take the guesswork out of hiring engineers

Why Louisiana Power uses automatic data logging

Admiral H. G. Rickover

OUR CRISIS IN EDUCATION





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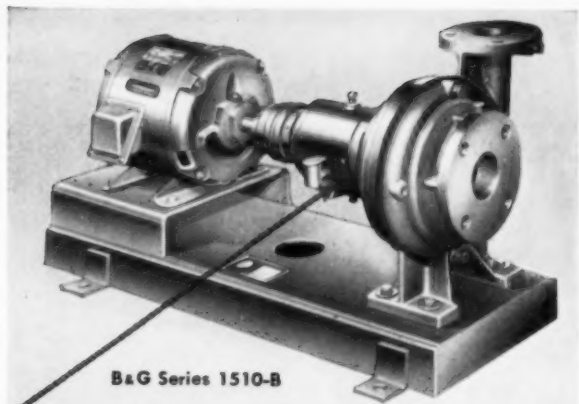
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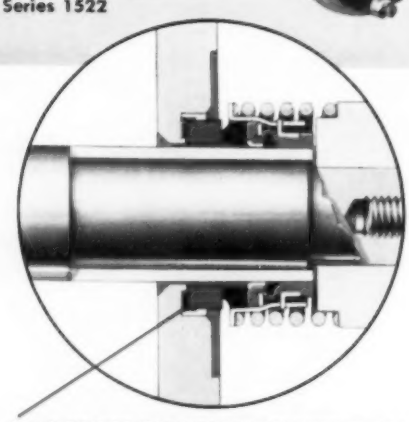
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March 17-21: Nuclear Congress and Atomtain, International Amphitheatre, Chicago.

March 17-21: NACE Annual Convention; Municipal Auditorium, San Francisco.

March 19-20: ASME Management Conference; Boston, Mass.

March 26-28: American Power Conference; Hotel Sherman, Chicago.

March 27-29: Electrical Maintenance Conference; Shrine Exposition Hall, Los Angeles.

April 1-3: ASME Conference on Instruments and Regulators; University of Delaware, Newark, Del.

April 14-15: ASME Maintenance and Plant Engineering Conference; Penn-Sheraton, Pittsburgh.

April 14-17: ASME Design Engineering Conference; International Amphitheatre, Chicago.

April 14-18: American Welding Society Annual Meeting and Show; Statler Hotel, St. Louis.

April 20-23: AICE Annual Meeting; Sheraton-Mt. Royal Hotel, Montreal, Canada.

April 20-25: American Water Works Association; Dallas, Texas.

May 4-7: Air Conditioning and Refrigeration Institute Annual meeting; The Homestead, Hot Springs, Va.

May 5-7: American Mining Congress Coal Convention; Netherland Hilton Hotel, Cincinnati, Ohio.

May 14-16: Pacific Coast Electrical Association, Inc. Annual Convention; Hotel Del Coronado, Coronado, Calif.

May 18-21: Industrial Heating Equipment Association, Inc.; The Homestead, Hot Springs, Va.

May 19-23: American Welding Society Spring Technical, National, and Welding Show; Hotel Schroeder, Milwaukee, Wis.

Circle 1574 opposite last page

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MARCH 1958

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VOL. 74 NO. 3

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SPOTLIGHT ON . . .

PEOPLE

Atomic Energy Commission confers its Distinguished Service Award on two employees. Honored are **Dr. Charles L. Dunham,** director of the Division of Biology and Medicine; and **Samuel R. Sapirie,** manager of the Oak Ridge Operations Office. Award is highest AEC can confer on its staff.

E. G. Bailey, Bailey Meter Co. founder, receives **ASME's** top award, elevation to rank of Honorary Member. Bailey is cited as a "devoted worker and imaginative leader."

Top officers slated to head **ASHAE** this year are announced. **E. R. Queer,** University Park, Pa., moves up from rank of first vice president to become society president. Vice presidents will be **A. J. Hess,** Los Angeles, Calif. and **Walter A. Grant,** Syracuse, N. Y. **J. H. Fox** of Toronto, Canada is treasurer.

J. Roy Gordon, widely known industrialist and metallurgist, is elected to the Board of Directors of the **Babcock & Wilcox Company.** Mr. Gordon is recent recipient of the AIME's James Douglas Gold Medal for 1958.

J. R. Gordon

C. H. Clark

Detroit Edison Company's president Walker L. Cisler names two men to head operations at the **Enrico Fermi Atomic Power Plant** — now under construction near Monroe, Mich. **Clarence H. Clark** will be superintendent of turbogenerator station; **Frank W. Shutko** will be superintendent of adjoining reactor plant. ◆

Fault currents throttled

in BullDog Unit Substations

Give your plant the economies of high-voltage distribution and maximum secondary protection with Cordon* breakers in BullDog unit substations. Cordon breakers safeguard circuits *three ways*. Thermal-magnetic action performs in overload and low fault areas. Amp-trap** action limits damaging high fault currents up to 100,000 RMS amperes to low values . . . prevents destruction of equipment by clearing the fault immediately. When any one Amp-trap opens, all breaker poles automatically trip preventing single phasing.

Add to plant safety, economy and production efficiency. Specify BullDog unit substations with Cordon current-limiting breakers. Contact your BullDog field engineer or electrical contractor, or write BullDog Electric Products Co., Detroit 32, Michigan.

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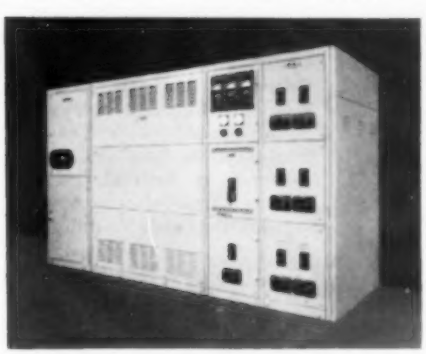

STANDARDIZED CONSTRUCTION of BullDog unit substations allows for easy expansion. Four frame sizes of the 100,000 RMS ampere IC rated Cordon breaker are now available—100, 225, 400, and 600 amps: 600 volt AC; 250 volt DC.

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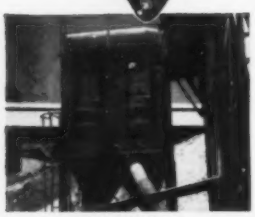

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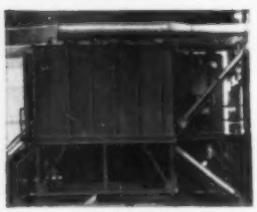

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Circle 1577 opposite last page

REPORTS IN BRIEF

Sputnik only the beginning . . .

USSR pacesets science, technology

Sputnik is only one of a procession of technological firsts from the USSR, according to paper presented at AIEE Winter General Meeting in New York City last month. Russian scientific supremacy results from the following: early and concentrated teaching of science in the schools; free or low tuition for capable students interested in higher education; excellent research and education facilities; extensive technical translating and abstracting facilities to keep USSR scientists up-to-date on developments in U. S. and Western Europe.

How much electric power was generated in '57?

Edison Electric Institute records show that generation of electricity by all industry reached 636-billion kwh in 1957, 35 billion over 1956. Electricity sales reached 561 kwh, 31 billion over 1956. Residential customers used 3164 kwh. Last year saw 8.5-million kw generating capacity added to the nation's power lines.

Piston head coating cleans up exhaust

Catalytic ceramic coating for piston heads reduces amount of carbon monoxide and unburned hydrocarbons in exhaust gas. Coating also serves as thermal insulation. It is in development at Armour Research Foundation.

Top brass: how does your salary grow?

Salaries of top executives increased only 5.1% last year, 0.8% under 1956 rise, according to American Management Association annual survey. Survey studied some 35,000 high-ranking executives in 3800 companies varying in size from those with annual sales under $1 million to those hitting the multi-million mark. Salary breakdown shows 49% received more money, 41% stayed the same, and 10% took a loss.

Electric eye 'sees' atomic radiation

Westinghouse Electric Corp. engineers are working on an electric eye that uses atomic radiation instead of a visible light beam. Radioactive isotope strontium-90 replaces light bulb in standard photoelectric cell systems.

Calculate cost savings from using computers

Richard H. Gherst, power engineer at United Engineers & Constructors, Inc., Philadelphia, estimates typical piping problems can be solved at a money-saving ratio of about 3.5:1 in favor of computers.

Savings are not only from personnel cost. Getting quick answers that are necessary before other areas of design can proceed, and eliminating errors that can happen when tentative piping configurations are substituted for calculated results are cited.

Sea lampreys drop dead!

Great Lakes Fishery Commission and US Bureau of Commercial Fisheries have successfully tested new chemical for controlling lampreys

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Circle 1578 opposite last page

in sea or fresh water. Precision mechanical feeder pours chemical into stream at rate of 30 ppm. In test stream, 92% of the lampreys were dead in two days. Chemical used is Dow Chemical Co.'s Dowlap.

Industry, users unite for research on coal

Bituminous coal industry, major coal users, and companies supplying equipment for the coal industry have joined together to establish a major coal research center, to be operated by Bituminous Coal Research, Inc.

There's uranium in them thar hills!

Atomic Energy Commission is considering proposal from Vitro Minerals Corp. and The Atlas Corp. to build a 1000-ton-per-day uranium mill in Gas Hills, Wyo., mining area. Initial exploration points to possible deposits of 1,500,000 tons of uranium ore in Vitro's Gas Hills property.

Chromed nickel, cobalt increases engine life

Chromalloy Corp. has perfected a process that protects high nickel and cobalt alloys by diffusing chromium over the surface. Treated alloys become highly resistant to chemical and high-temperature corrosion, making them suitable for jet and internal combustion engines, gas turbines, engine components, nuclear reactors.

Alloy metal bar cuts corrosion

Special alkaline alloy metal bar about 4 inches long can protect fuel storage tank from corrosion, eliminate formation of varnish and sludge in heating coils. Developed by Johns Manufacturing Co.,

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Rotojet Electric Tube Cleaner thoroughly cleans straight tubes from 25/32" to 4" I.D. in boilers, condensers, evaporators, and heat exchangers so quietly that it can be operated without disturbing anyone.

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Rotojet Electric Tube Cleaner with swing-frame head.

4-way drill and universal coupling.

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Circle 1579 opposite last page

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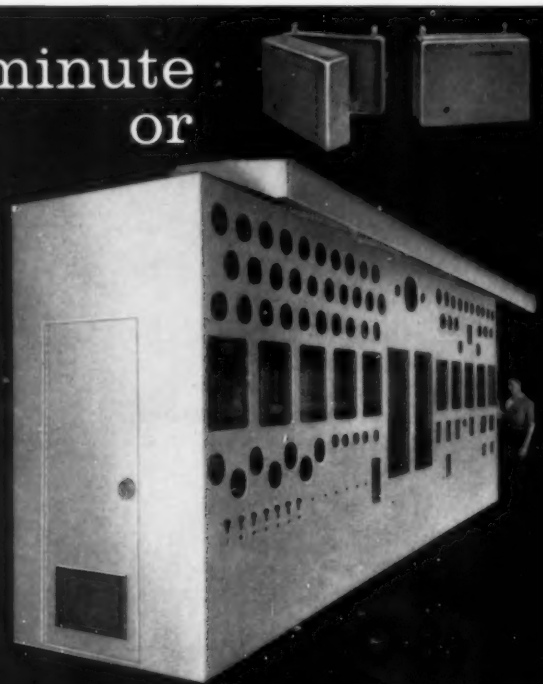

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METAL FABRICATION

Circle 1580 opposite last page

REPORTS IN BRIEF

Magna-Bar's special composition neutralizes sludge-forming catalysts and corrosive acids. Bar installs quickly in storage tank—hangs from wire attached to tank cap.

GE lowers prices on transformers

General Electric Co. is cutting prices about 4½% on its pole-type distribution transformers. Two production factors make price cut possible: use of cold rolled oriented core steel and better equipment and production methods at new transformer factory at Hickory, N. C.

Westinghouse, PP&L join on reactor project

Westinghouse Electric Corp. and Pennsylvania Power & Light Co. have a joint proposal before the Atomic Energy Commission to build a homogeneous nuclear reactor with a 70,000- to 150,000-kw capacity. Research to be completed in 1959 will determine whether or not project receives AEC blessing.

New plant to burn both natural, flue gas

The Fluor Corp., Ltd., receives Standard Oil Co. of California contract to build 275,000 lb/hr generating plant at El Segundo, Calif., refinery. Plant will burn natural gas and catalyst regenerator flue gas simultaneously.

GE builds super-size rectifier system

General Electric Co.'s Rectifier Department at Lynchburg, Va., is building the country's largest silicon rectifier system for Hooker Electrochemical Co.'s Niagara Falls, N. Y. plant. Rated at 17,300 kw, system will be installed this year. ◆

Is your plant CRITICALLY SHORT of WATER?

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High operational efficiency means: precise temperature for improved product and process quality control, heat removal at rate of input, simple operating conditions, real economy in upkeep, sustained full capacity.

Also it means cooling in a closed system with your product kept free from contamination or, when condensing, getting a pure condensate holding high quality in your product or material.

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Circle 1581 opposite last page

MARCH 1958
VOL. 74 NO. 3
POWER INDUSTRY

Why we are using an Automatic Data Collection System

By DON L. ASWELL
Engineer
Louisiana Power & Light Co.

Within the next month we expect to have Sterlington Steam Electric Station in operation. Sterlington, Louisiana Power & Light Company's newest baby, is a logical development from Nine Mile Point Steam Electric Station, which was an almost automatic station.

Sterlington will carry the trend a little further toward the ideal (a pushbutton station that is currently in the initial planning stages).

Among the innovations to be incorporated at Sterlington is an automatic data collection system that uses an analog to digital integrating translator.

The ADC (more popularly known as DADIT) is installed on 200-mw and 43-mw rated units. It will be used to:

- Scan 250 temperatures during operation of the units at a rate of 5 points per second. These temperatures consist of bearing and bearing oil temperatures on the main unit and auxiliary equipment, boiler superheater and reheater tube temperatures, condensate steam temperatures, transformer temperatures, and other temperatures important to plant operation.

Should any of these temperatures register higher than a preset alarm point, the digital reading will be printed out and an annunciator will sound an alarm and identify the off-normal point.

Printout of the off-normal will continue during each scan cycle until the temperature is corrected or the equipment in trouble is taken from service

- Log out in digital form any of the scanned temperatures on demand from the operator
- Periodically log, on prepared log sheet, another 100 plant readings necessary for accounting and trouble-shooting records. These include flows, pressures, temperatures, heat rates, electric amps, volts, megavars, and kilowatts.

The DADIT system (unveiled at the ISA show in Cleveland last September) consists of a computer with a 1024 word memory. This equipment can be programmed to give any set of readings required, and can be used to obtain corrective control action for various off-normal points.

This latter feature will be utilized on this unit only for testing and experimenting with the computer. The computer consists of solid-state circuitry with some mercury relays.

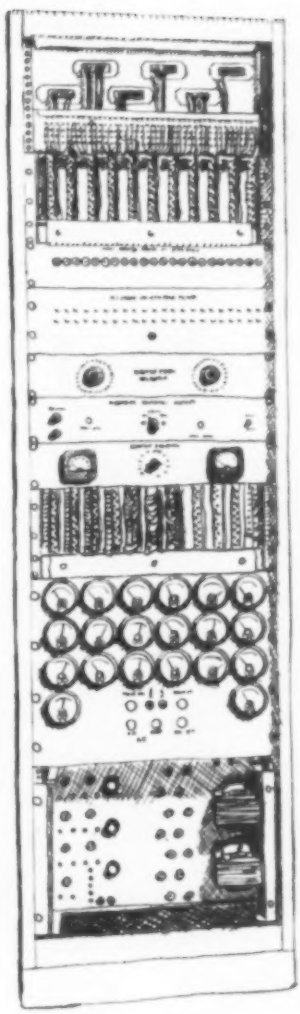
We have not installed this equipment to save manpower. In our plant operation, we have *at present* stabilized with a minimum of three operators per shift for a single-unit plant. We believe this to be a minimum requirement in case of accident or illness, and because of the fire hazard involved in a power plant.

Our reasons for installing the system are:

- More accurate records for accounting and trouble-shooting will be obtained now than was possible previously with an operator using a log sheet
- During crises, records will be obtained which should prove valuable in quickly getting equipment back into service after failure
- Equipment will be more closely supervised than has been possible previously
- The operator will be relieved of normal log sheet readings to enable him to give closer supervision of plant operation
- Our most important reason for installing this equipment is to provide operating experience with a type of equipment that we believe will be used in the completely automatic power plant, namely the continuous computer scanner.

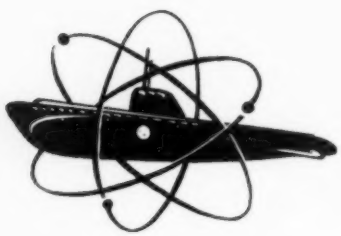
For the near future, possibly in our next plant, we are actively planning a completely automatic steam electric plant to start up and operate automatically. Again, the manpower saving will not be evaluated. Rather, all maloperations, normally occurring when an unpredictable human is operating, will be omitted.

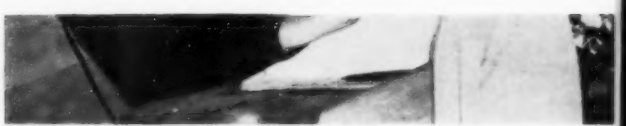
Then automatic equipment, supervised and controlled by the computer, will take over sequential startup, operation, and shutdown. All other reasons are minor as compared with this one. ◆



Where are our engineers and scientists of tomorrow to come from? We face a real crisis — not of manpower, but of brainpower. Our educational system is not geared to here and now. To continue with our present policy can be disastrous . . . right now we may be . . .

EDUCATING FOR





By Rear Admiral H. G. RICKOVER, USN

The United States has recently undergone a period of rude awakening. We have been assaulted by distressing news about Russia's strides in technology. Russia has had extraordinary success in transforming her educational system—all but in ruins 20 years ago—into the most efficient machine for producing highly competent scientists and engineers.

She has trained many more men than we can hope to train through our own educational system, which we have so long regarded with pride and affection.

We are slowly realizing with bitter disappointment and humiliating truth that a 19th century educational philosophy is as hopelessly outdated today as the horse and buggy.

Nothing short of a complete reorganization of American education, preceded by a revolutionary reversal of educational aims, can equip us for winning the educational race with the Russians.

Ours is a democracy. We cannot advance faster than the majority of the people will permit us to go. Today, the people are aroused because they sense that something is fundamentally wrong with American education.

This is proven when a country—75% illiterate a generation ago—can catch up with us within 20 years in such important fields as science and engineering. The mass of well-reasoned criticism, currently filling the air and the news columns, is so large as to be almost indigestible.

Let me condense it to a few major points. For greater details, I can think of no better source than the Hearings on the "Shortage of Scientific and Engineering Manpower", held in April and May 1956 before the Subcommittee on Research and Development of the Joint Committee on Atomic Energy of the Congress of the United States.

Stop Stagnation

These hearings brought forth all the facts needed to understand the problem as well as enough good suggestions for practical reforms to undo in reasonable time all the damage done our children and our future by 50 years of educational stagnation.

Similar help will come from

EXTINCTION

Admiral Rickover is one of the few men who sees through the rose-colored mist surrounding our educational crisis. His article is *must reading* . . . Whether you have school-age children or not, you'll want to make your voice heard. "Educators" are a professional group. They do not know what you know about *technical* education.

Before writing or seeing your congressman, PTA, or school board, get a copy of the Joint Committee on Atomic Energy of Congress report on "Shortage of Scientific and Engineering Manpower." Write Joint Committee on Atomic Energy, U.S. Congress, Washington 25, District of Columbia.

The Editors

the Preparedness Investigation being conducted by the Senate Armed Services Committee.

No American can consider himself a conscientious citizen unless he takes the time and trouble to read these documents and to think them through. I, myself, have found them most helpful in forming my own views on American education.

In my work in nuclear energy, I became aware of the defects in our school system as long as 10 years ago. Since then I have interviewed more than a thousand young college men and officers.

The design and development of nuclear power plants is a difficult scientific and engineering project. It encompasses the most advanced concepts in physics, mathematics, chemistry, metallurgy, electrical engineering, electronics, and mechanical engineering.

Young men with sound fundamental scientific and engineering knowledge and proper motivation are needed to carry the project forward. Despite the numbers who apply, I have never found more than a very small percentage who had the necessary qualifications for our nuclear projects.

I could not but come to the conclusion that something was radically wrong with the schools and colleges to whom the education of these young men had been entrusted.

Our Disastrous Daydream

I think we have come to the pass we are in today because our mass media wrap us in a cocoon of soothing "Coué-ism" along the lines of "every-day, in every way, things are going to be better and better." Few of us read serious books. We are, therefore, singularly defenseless against the continuous flood of optimistic predictions of a future with delightful superabundance—just around the corner—that American science will provide.

We are equally defenseless against the clichés of our forklore, which assure us that America is and always will be the most technically advanced nation. Or that ours is the most marvelous educational system in the world because more teenagers are in school in the U. S. than anywhere else.

This silky cocoon has kept us isolated from the educational practices of even our closest European allies. A few hours' check of their curricula, teaching standards, and end results would disabuse us speedily of our illusions.

It seems to me that the first step in tackling the American educational problem is to collect all the pertinent data concerning education in other Western nations. Then present it to our people clearly and with dispatch.

I am thinking of the sort of thing done by the Department of Health, Education, and Welfare when it published its recent useful "Report on Education in the USSR." We need all the information and we need it now. At little cost, much help for planning educational reforms could be made available.

Of course, no educational system can guarantee that it will bring forth genius at any given rate. It can, however, make it easy for genius to be discovered early, nurtured and encouraged, and allowed to flower according to its own inner motivations.

Can we truly say that our education system does this? I think not.

Nor does it even seek out, nurture and develop mere talent—as contrasted with genius. It fails to develop in our most intelligent youngsters the desire to make the best use of their good minds.

Hence we see 200,000 of the top-quarter high school graduates lost each year to higher education. At the same time, the nation suffers an acute shortage of trained professionals in all fields, and a disastrous shortage of vital scientists and engineers.

One of the great defects of our educational system is that it does not respond to changing national needs for specific kinds of professional people. Because of the considerable latitude allowed the student in selecting subjects, not only in college but even in high school, he may be unprepared to study for a given profession. He may virtually bar himself from it unless he has deliberately begun to prepare himself in high school.

For example, we need a great many physicists *now*. But a youngster who has taken no physics and little mathematics in high school (true of

continued on page 31

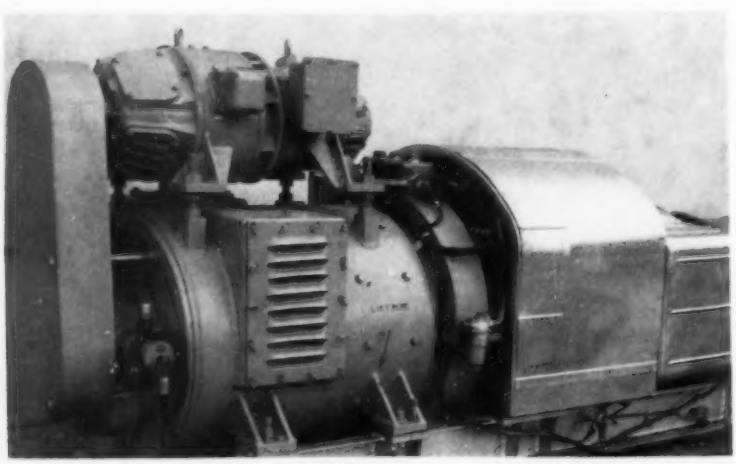
Originally developed to provide power for high-speed military aircraft during World War II, now . . .

Gas Turbines come down to earth

Gas turbines were developed during World War II to cope with the demand for higher power-to-weight ratios. When the war ended, engineers began to develop the idea of putting them to work for industry. The result is a brand-new concept in power plants. Experience has proven the effectiveness of gas-turbine-power for power generation, pipeline service, chemical processing and oil refining. Units in the 50 to 500 hp range — small-size gas turbines — serve diversified customers and perform different functions in wide areas of application.

One of the most satisfactory applications of compact, economical gas-turbine power plants is pumping natural gas. Located at remote pumping stations, gas turbines take fuel directly from the gas pipeline, assuring a continuous and economical source of fuel.

The gas turbine's small size makes for an easily installed, low cost pumping package, capable of being shut down for extended periods without special protective measures. Low day-to-day maintenance and zero water consumption make the gas turbine an ideal source of pumping power.



Compact, lightweight power source. This Solar gas turbine electric generator develops 210 kw, yet weighs only 1/5 as much as a comparable piston generator.

As a general power plant, the gas turbine offers the advantages of reliability, compactness, and low weight. Some power companies are using gas turbines as supplemental power plants.

For instance, a central power station can boost its output with turbine-powered generators at minimum cost. Or it can install a turbine to handle peak or seasonal demands at a remote end of a transmission line.

It can be turned on or shut down in seconds — even by remote control — saving power and providing greater operational flexibility than conventional plants.

Standby and Emergency Power

Perhaps the most immediate potential of the gas turbine is for industrial standby and emergency power. For emergency power units, reliability in starting is of prime importance.

A 300-kw gas turbine generator can be installed in the same space as a 60-kw diesel set. Total installation costs, in terms of kw output, are about the same — an important factor where electric power demands are increasing.

Both ac and dc generator sets are powered by small gas turbines. Units can start and operate efficiently at any altitude and in temperature ranges from −65 to 130°F. At sea level, the unit can be cranked up to full speed and full load capacity within 15 seconds.

Forestry and civil defense groups have shown a great deal of enthusiasm for the potential of gas turbines to power portable fire-fighting assemblies. Tests have proven that turbine-powered pumps are perfectly suited for emergency operations.

Solar Aircraft Co. manufactures a compact, lightweight unit that delivers 500 gpm of water yet is light enough to be carried by two men. Significantly, this is the capacity of most fire engine trucks. Designed as a fresh or sea water pump, the Solar unit can be started by hand and operated on several fuels.

Other advantages of the gas turbine are:

- It will burn diesel fuel, less flammable than gasoline
- It needs no cooling system
- It can be started by one man using a hand crank
- It is sure-starting under low-temperature conditions, even after long periods of inoperation.

The gas turbine has reached a stage of development which

A hand carried fire engine. This fire pump, carried by two men and powered by a 50 hp Solar Mars engine, can pump as much water at high pressure as a class B fire engine, or as much as a 1500 pound piston-powered pump.

indisputably marks it as the engine of the future.

The immediate promise of the gas turbine is in everyday industrial applications:

- Where use is occasional, with long periods of standby
- Where weight, space and mobility are important
- Where fuel cost is low or insignificant in terms of overall operating costs
- Where fuel versatility is of importance
- Where instant starting in temperatures ranging from —65 to 130°F is needed
- Where there are interrelated requirements for heat or compressed air in addition to shaft power.

Manufacturers are taking advantage of these small-size power packages to produce more power with less bulk and with better overall operating economy.

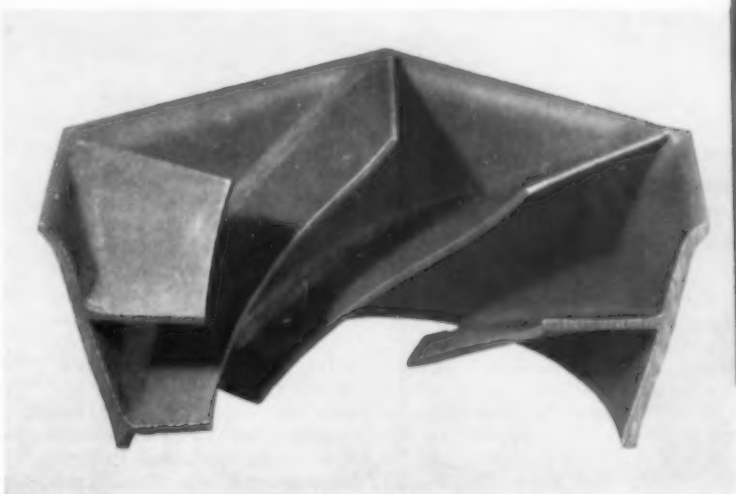
Wartime power thus becomes practical today.

(Gas turbines were manufactured by Solar Aircraft Co., 2200 Pacific Highway, San Diego 12, Calif.)

Circle 1582 opposite last page.

HAGAN DUST COLLECTOR CUTS COSTS

...of air pollution control
...of product recovery



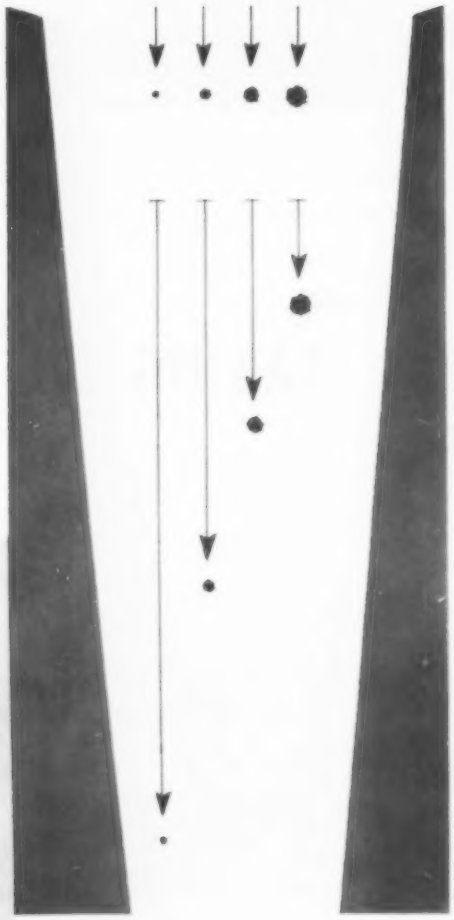


Diagram shows how Selective Particle Acceleration works. Venturi effect of individual inlets accelerates gases on a 6 to 1 ratio. The larger, most abrasive particles pick up the least speed —smaller particles are accelerated the most. All are efficiently separated, but wear on tubes is sharply reduced.

The Hagan Aerostatic is the only mechanical dust collector with Selective Particle Acceleration. This unique feature increases efficiency so that it approaches that of electrostatic precipators, and reduces tube erosion to the vanishing point.

Detail of tube assembly. Note Hexagon shape of tops—there are no flat surfaces, so it is impossible for dust to accumulate and clog tubes.

Here are the facts on SELECTIVE PARTICLE ACCELERATION:

The patented, spiral inlet vane ports have a decreasing cross-sectional area—in effect—a venturi. Gases moving through the ports increase to 6 times their velocity within a space of only three inches.

Small particles (1 to 10 micron range), having very little inertia, are accelerated rapidly, approaching stream velocity.

Larger particles, with more inertia, pick up speed more slowly. They are collected with the same high efficiency, but at low velocity.

Result—the full range of particle sizes are efficiently collected, but the larger and more abrasive particles move at speeds that reduce abrasion drastically.

Write for Descriptive Bulletin MSP 124 A. It contains a complete description of the economical and efficient Hagan Aerostatic Dust Collector.

HAGAN CHEMICALS & CONTROLS, INC.

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

Circle 1583 opposite last page

Hiring engineers? Should you choose Smith or Jones? Remember that your company isn't the only interested party — to be successful, both you and the engineer must have specific, well-defined ideas of what you are after. Here are some suggestions for . . .

TAKING THE GUESSWORK OUT OF HIRING

By D. W. KARGER
Manager, New Product Development
The Magnavox Company

POSITION DESCRIPTION: GRADE A STAFF ENGINEER FOR PLANT ENGINEERING

DUTIES AND RESPONSIBILITIES

GENERAL

Carry forward to completion with only minor direction major and minor projects. The general objective and the general scope of the project to be supplied by the department head.

Examples of major projects: Accomplish the necessary engineering and supervise the installation of such items as a new production facility, modernization of an electrical distribution system, an additional boiler, etc. Another type of major project would be the development and installation of a preventive maintenance program.

Examples of minor projects: Investigation and correction of window breakage in an area or investigation and correction of low water pressure in an area.

The engineer may have other engineers assigned to him at various times to help him accomplish the assignments. He in turn may at various times be requested to assist other engineers with their projects.

SPECIFIC DUTIES AND RESPONSIBILITIES

Because of the wide variety of problems and the broad scope encompassed by many assignments given to the plant engineering staff, the engineer may be required to perform any or all of the following functions assigned to the plant engineering department.

- Perform necessary industrial, mechanical, electrical, and chemical engineering required for plant maintenance, construction, and remodeling
- Develop and administer building and facility improvement programs
- Develop and operate plant engineering cost control systems
- Estimate necessary facility and building costs
- Direct and supervise craftsmen such as mill-wrights, electricians, carpenters, pipefitters, welders, sheet metal workers, machine repairmen, handymen, yardmen, janitors, painters, etc.
- Construct wood jigs and fixtures
- Handle all contractor problems related to plant engineering projects
- Properly dispose of surplus equipment
- Physically control all company and government owned equipment and facilities
- Operate and control consolidated maintenance and repair stockroom
- Operate and control all facility records including related maintenance costs
- Affix identification to all capitalized assets
- Operate all control phases of factory work order system
- Develop and operate preventive maintenance programs
- Analyze cost and report on required corrective action
- Perform other required duties assigned by plant engineer.

The acute shortage of engineers makes proper selection of new men an extremely important function of personnel departments and management. An added incentive to do a good hiring job is the fact that each new man represents an average expenditure of $2000 to $5000.

A dud can easily cost the company ten times as much. Yet in spite of these factors, there are still many who have not decided just exactly what they want.

The most successful marriage of an engineer with a new firm occurs when:

- The engineer's personality, education, and professional background fit the job requirements
- The engineer likes the kind of work offered
- The company and the engineer mutually agree that he will fit in well with his coworkers and associates
- The community offers the kind of living that the engineer and his family would enjoy.

These are major considerations, any one of which could cause an ultimate failure of the marriage if not adequately fulfilled. The first three affect the employee and his company most directly and are personally important to him. He spends most of his day at the plant. Even at home he normally will consider his plant problems and challenges. The man and the job must suit each other.

Before looking more closely at the first two, let's mentally consider this question. Are your verbal instructions, even simple ones, often misinterpreted?

There can be only one answer — an emphatic *yes!* This being true, it is obvious that each job opening should be defined in writing and in detail, as precisely and accurately as possible.

How else can the first two considerations of an engineering employee acquisiton be fulfilled? If this is not done, the personnel department will give your new engineer a second- or even third-hand garbled verbal description of the job.

Describing a Job

Job definition can best be accomplished by developing a Position Description. This is not a "cure-all." It doesn't solve all employee recruitment problems, but it is a great help.

Developing a description for each job is not as difficult as it might appear. After several have been done, much of the data in these can be used in other Position Descriptions for similar jobs. Many firms find it advantageous to develop

POSITION DESCRIPTION: GRADE A STAFF ENGINEER FOR PLANT ENGINEERING

GENERAL AND EDUCATIONAL REQUIREMENTS

AGE: 30-45.

PHYSICAL CONDITION: Good.

HOME ENVIRONMENT: Good to excellent.

APPEARANCE: Good to excellent.

EDUCATION: College graduate or equivalent. Electrical Engineering or Mechanical Engineering graduate with engineering experience — first choice. Industrial Engineering graduate with plant engineering experience — second choice.

MOTIVATION: Should have an intense desire to succeed.

PERSONALITY: (IMPORTANT) Must be excellent.
Must have the personality that makes it possible for him to sell
- Himself
- His department
- His work

STABILITY: Must be able to perform well under consistent and extreme pressure.

REPORT WRITING: Must be good to excellent. The ability to develop concise, to the point, reports is a must.

WORK EXPERIENCE: Five (5) Years minimum experience.
The greater portion to be in plant engineering. He should have had a good combination of some of the following areas of experience, however,:
- Development and administration of preventive maintenance programs desired
- Factory or equivalent work simplification experience
- Building construction
- Plant engineering project development and administration
- Mechanical engineering design
- Electrical engineering design
- Plant engineering administration (general)
- Maintenance work
- Drafting
- Supervision of maintenance workers.

KNOWLEDGE: He should have a reasonable understanding and knowledge of all the various items mentioned under work experience.

these for each job type in offices or laboratories.

They not only help to find proper replacements, but assist in: eliminating duplication of effort on the job, job evaluation (aimed at the establishment of equitable job pay rates for each work classification), development of systems and procedures, and personnel training.

Position Descriptions ordinarily consist of three main sections — I-Personal, Educational and Professional Requirements, II-Duties and Responsibilities, and III-Relationships with other departments and functions. The boxes on this page show a typical Position Description for a staff plant engineer with a major industrial firm.

The initial reaction to section I is that it is relatively unimportant and therefore easy to to develop. Don't let this fool you into making sloppy definitions or statements.

Such items as job title, educational requirements, age limits, etc., need little or no elaboration. But let's look at some of the other statements in this section.

Do you want and do you specify the motivation and personality for an ambitious, driving self starter? Good enough — but recognize the fact that this type will expect more responsibility in one to two years. If he doesn't get it, he'll be likely to leave. If the job to be filled is routine and is not used as training for more responsible positions, then don't specify this type of individual. If the correct type is specified, it will save everyone a lot of headaches and promote a better employee-employer relationship.

It is important to be precise in developing section II. List all major tasks that the recruit is likely to perform. This section can then be used by the interviewers and by the man to evaluate the job offer as to:
- His qualification for work
- His ultimate satisfaction with the work.
- The degree of professional development and opportunity offered.

We said earlier that one of the prime factors involved in getting a satisfied employee is a mutual agreement that he will fit well with his co-workers.

This can be determined by the recruiter evaluating the employee's personality, education, and professional background in relation to his prospective co-workers by allowing the employee to talk privately with one or two of them. The men on the job will help sell the company and the job. They also will give you a private evaluation of the prospective employee.

Psychological testing, as an adjunct to personal interviews, is a proven help. Whole books have been written on this aspect of the problem. The results of such tests are merely indicators and should be verified by personal interviews.

Don't pass up a prospective employee because of average test results.

A test often used when selecting tool designers or draftsmen is a spatial relations test. It purports to evaluate an individual's ability to visualize objects in space and correctly depict them. It has been my experience that average to low scores do not necessarily mean poor ability in the above fields. I have found that well-qualified men, *who turned out to be excellent employees,* scored low to average on this test.

Most test batteries include some form of an intelligence test, a personality test, and an interest test. While the first is by far the most useful — personality and interest tests help to verify your impression of the prospective employee's make-up.

Look Further

Don't fail to explore the prospective employee's family life. This is especially true for executive and major staff positions. Many firms today consider it essential to meet the wife as an aid in evaluating internal family relationships and to determine whether she would assist or hinder her husband in his position.

Check with his former superiors. Doing this by telephone is better than writing, since much important related information can often be obtained in no other way.

Failing to check *can* be disastrous. Yes, I've been fooled, too — even the most experienced interviewer can be fooled by a well written resumé and a "fast talking" prospective employee.

Chamber of Commerce brochures and other booklets describing the city should be given to a prospective employee to take home for family discussion. If the city is near resort areas or state parks, brochures describing these should also be available. A dissatisfied wife can kill an interview or cause a recently hired employee to leave.

Discussion of employee selection cannot be left without covering multiple interviews. Don't depend on just one person's evaluation. Have several men interview the applicant

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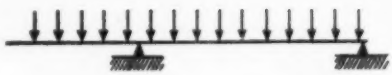
POSITION DESCRIPTION: GRADE A STAFF ENGINEER FOR PLANT ENGINEERING

RELATIONSHIPS WITH OTHER DEPARTMENTS

The engineer will be required to cooperate and work with both top management and operating personnel in the following departments or functions:
- Design and product engineering departments
- Factory engineering department
- Quality control department
- Industrial engineering department
- Personnel and industrial relations departments
- Accounting departments
- All manufacturing departments
- Management executives

Are you the sole judge in condemning existing structures? They should be given the same consideration as humans — innocent until proven guilty



are you underrating your present structures?

It can cost time and money. Here's how to take advantage of conservation design and real value instead of rebuilding

By KEITH E. McKEE
Mechanical Engineering Research Department
Armour Research Foundation

Structures are often condemned without a fair trial. Many companies fail to make maximum use of their present structures because of a mistaken concept of load-carrying capacity.

During the past several years, Armour Research Foundation has conducted investigations on many types of structures. The structures have included such items as buildings, coal bunkers, ore bridges, floor systems, and crane booms. In general, these structures had a strength exceeding that for which they normally are given credit.

Most investigations that we have been conducting have been initiated by the owner's desire to increase loadings. Modern material handling equipment and procedures require live loads exceeding those contemplated by structural designers of a decade or more ago.

Too often, present load limitations make it impossible to use a structure efficiently. This inefficiency may show up as uneconomical operating techniques or show that the structure requires extensive alterations or replacement.

For many of these structures, more accurate knowledge of load-carrying capacity would increase their usefulness.

Permissible load-carrying capacity of many structures often is based on data used in the original design. This could, of course, be representative of the true strength of the structure. But, it is normally conservative. Generally, the actual structure is built with greater strength than that in the designer's imagination. Reasons for this are:

- Design procedures in general are very conservative. This is particularly true of typical practice a generation or more ago
- For design, the strength of the materials used is underestimated
- After following a standard design procedure, something is added for good measure
- Designers attempt to anticipate the whims of their superiors. They design for increased live loads, which they feel will be required in the future
- Limited knowledge of structural action requires design assumptions that are necessarily conservative.

The first four reasons listed above can be verified by a detailed analysis of the structure, as built. The fifth reason, which may be the most significant, cannot be accounted for by normal analytical procedure.

How to Check

In evaluating a structure, three steps — determination of the problem, anlyses, and load testing — must be taken. This approach is equally applicable for any type of structure.

It should be noted that the steps are carried out in the order given. At any step, however, a satisfactory solution may be obtained. Further consideration is then not necessary or justified.

The first step is to deter-

(Left) Typical installation of strain gages and deflection indicators on bottom of beams and girders. Deflection gages are located for easy reading.

(Center) Strain gages are connected to Baldwin strain indicators. Multi-position indicator permits readings of many separate gages with one instrument.

(Right) Deflection gages indicate beam movement with movement of fork lift truck on floor above.

mine the problem. This includes gathering all available information regarding the structures from records, drawings, field inspections, recollections of individuals, etc.

This information often may be difficult to obtain, but is necessary to evaluate any structure. Equally important is information relating to the contemplated loading. This knowledge may be the key to the entire problem.

In evaluating existing structures for contemplated loading, there is no justification for basing calculations on arbitrary loading requirements.

If information is available to indicate that an evaluation is necessary, it should also be sufficient to make accurate determination of the loads possible. Future consideration can be based on an accurate estimate of the load to be expected.

The second step is an accurate analysis, using all information obtained in the first step. Every attempt should be made to give the structure credit for its full strength. In general, the analyses should be the best available. Approximate analyses, often used in design, have no place in this type of investigation.

The problem, in some respects, is simpler than that encountered by the designer. No decisions need be made with respect to general layout, spacing of components, con-

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Why Every Steam Heated Unit Needs its Own Steam Trap

. . . the theory, practice and proof of "unit trapping" for top temperatures

Using an individual trap for each steam heated unit, including each separate coil, chest or chamber of a machine—pays off for the user. Here are just two examples:

1. On a creamery dryer

Drainage Method	*Air Temperature*
Restricted Blow-thru	250°
Group trapping (1 trap for 8 coils)	225°
Armstrong Unit Trapping (8 traps—1 for each coil)	**309°**

2. On a platen press

Drainage Method	*Processing Time*
Restricted Blow-thru	50 minutes
Group Trapping	35 minutes
Armstrong Unit Trapping	**25 minutes**

Why Unit Trapping Works Best

It is reasonable to assume that no two steam heated units will have *identical* condensing rates. Even the slightest difference in rate will cause a difference in steam pressure drops through the units. Here's where the trouble starts. Condensate from each unit may flow to the trap. But, what about air and other non-condensibles in the system? A difference in pressure drops too small to be indicated by an ordinary pressure gauge will permit backflow of steam from the higher pressure units to the lower pressure units. This backflow of steam may even impede flow of condensate from the lower pressure unit to the trap . . . and it will definitely impede or block off flow of air to the trap. The result is sluggish heating, reduced temperatures, reduced output, fuel waste and increased possibility of corrosion. Figures 1, 2 and 3 diagram the action.

Unit Trapping Not Costly

No engineer wants any more mechanical devices in his plant than are absolutely necessary. But, the moderate additional cost of using two or more small traps, instead of one big one, is saved over and over again in improved efficiency.

If the traps are Armstrong, maintenance is no problem. And users frequently tell us that Armstrong traps outlast others two and three to one.

Steam traps usually represent a fraction of 1% of the cost of the equipment they drain. Does it make good sense to lose 10% or more of equipment capacity to save a few dollars on traps?

Why not test Armstrong unit trapping in your plant. If you are not completely satisfied with the results you can return the traps for a full refund of the purchase price. There is little to lose—lots to gain. Call your local Armstrong Factory Representative or Distributor, or write **Armstrong Machine Works, 8202 Maple St., Three Rivers, Mich.**

ASK FOR the 44-page Steam Trap Book and reprint of article on Unit Trapping.

801ST

How Different Condensing Rates Can Slow Production

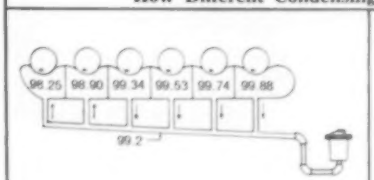


Fig. 1 This is a 6-roll ironer shortly after it has begun operating on 100 psi steam. When cold, wet material passes over chest 1, steam condensing rate is high and pressure drops accordingly. The pressure drop in chest 2 will not be as great, and so on down the machine as the material becomes progressively hotter and drier. Average pressure in the chests then is 99.27 lbs., and drain header pressure is slightly less, about 99.2 lbs. Under these conditions, steam from drain header enters chests 1 and 2 (as indicated by arrows at side of drain lines) because of pressure difference. Though condensate from chests drains by gravity, air can't leave chests countercurrent to incoming steam. Fig. 2 shows what happens next.

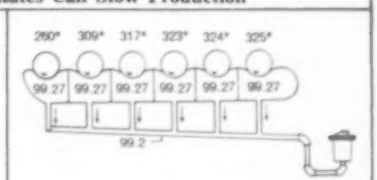


Fig. 2 This is the same 6-roll ironer after it has been operating a while. Air has accumulated in chests 1 and 2, reducing condensing rate and decreasing pressure drop. This process repeats itself down the line until pressures are as shown—that is, enough air will accumulate in each chest so that condensing rates and pressure drops of all chests will be about equal. The net result is shown in chest temperatures which are actual pyrometer readings taken on a 6-roll ironer, drained by a master trap, in a Chicago laundry. The laundry was making 337.9°F steam, but getting an average of only 309.6°F from the ironing surfaces, necessitating slow operation and frequent reruns. Then they tried Armstrong unit trapping—see Fig 3.

How Unit Trapping Prevents Trouble

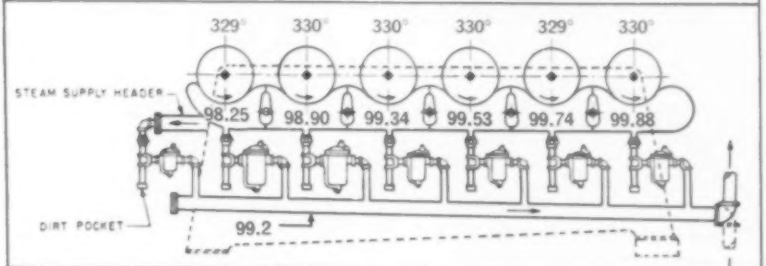


Fig. 3 This is the same 6-roll ironer, now unit trapped. Temperatures shown are also actual pyrometer readings—the average of 329.6°F is 20° higher than with group trapping. This is because air is continually removed from each chest into the drain header, and cannot get back into any chest.

ARMSTRONG STEAM TRAPS

Circle 1584 opposite last page

NEW DEVELOPMENTS

High-temperature insulation hooks on pipe

Built-in tie wires speed installation of flexible pipe covering that withstands temperatures to 1200°F. Insulation is moisture-resistant spun mineral wool. Built-in rectangular wire mesh and tie wires fit insulation tight around pipe. Permanent fastening is made by hooking tie wires across seam. Insulation is designed for runs of pipe that

High-temp insulation conforms to pipe contours

are to be weatherproofed with sheet metal or roofing felt.

Low alkalinity factor keeps insulation from corroding pipes. Ideal for nested pipes and steam traced lines.

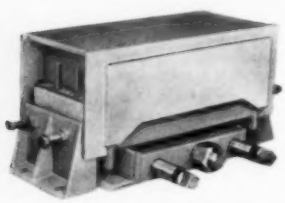
Insulation comes in 2-foot sections 1½ to 4 inches thick. Covers 4- to 30-inch pipes.

(No. 101 Pipe Insulation is a product of Baldwin-Hill Co., 500 Breunig Ave., Trenton, N. J.)
Circle 1585 opposite last page.

Machinery mounts hold 125,000 lb

Machinery mounts simplify installation of heavy equipment, frequently eliminate need for special chassis or foundations, and act as vibration, shock, and noise isolators. Mountings consist of heavy-duty welded all-steel housings containing high carbon helical steel springs as isolation medium.

Housing members are held in position against lateral movement by resilient chocks that take up horizontal thrust and can be adjusted for degree of damping to limit vertical and horizontal oscillation. Side access to adjusting bolts simplifies levelling.



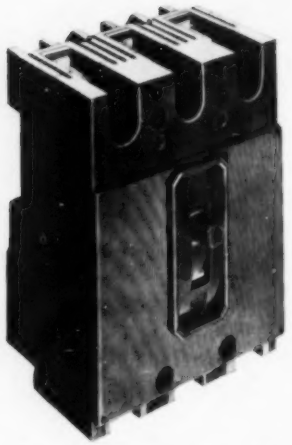
Machinery mount adjusts easily from side

Mounts come in 7 load-carrying capacities from 38,000 to 125,000 pounds each. Mounts are 20 to 35 inches long; 12 to 20 inches wide.

(SW machinery mounts are a product of The Korfund Co., Inc., Long Island City, N. Y.)
Circle 1586 opposite last page.

Circuit breaker needs less mounting space

Molded-case 100-amp circuit breaker for panelboards, switchboards, load centers, individual enclosures, takes 40% less mounting space than other breakers of same capacity. Special features include common tripping, quick-make quick-break operation, and a three-position operating handle. Shunt trips, undervoltage trips, auxiliary and alarm switches optional.



Circuit breaker permits quick-make quick-break operation

Breakers are two- or three-pole construction, 10 to 100 amps continuous, 480 volt ac, 250 volt dc, with interrupting rating of 10,000 amps. Breakers meet Federal Specifications WP-131A as Class C1, C2, and C3 breakers.

(EH frame circuit breaker is a product of I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.)
Circle 1587 opposite last page.

Strips insulated wire without nicking

Wire stripping tool strips 14- to 24-gauge insulated wire without nicking or cutting. All

Settings are quick, easy

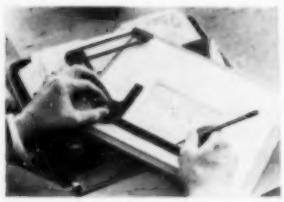
settings are made quickly with thumb-operated star gage. Small size (5 inches long) permits work in tight places.

(Wire Stripper 299 is a product of Proto Tool Co., Los Angeles, Calif.)
Circle 1588 opposite last page.

For more information on New Development items circle corresponding numbers on reader service card opposite last page.

Drafting instrument fits in briefcase

Draftette takes the place of T-square, ruler, protractor, and triangles on high-accuracy drafting and designing jobs. Draftette and its 10- by



Handy instrument replaces triangle, T-square

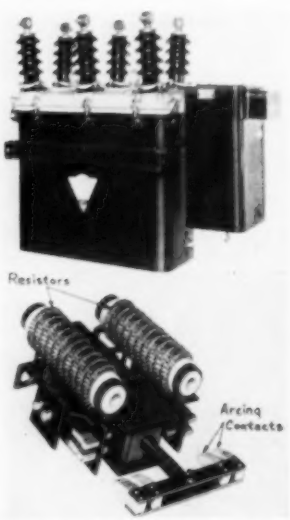
13-inch drawing board fit into standard briefcase. Scales on aluminum Draftette are in white on anodized jet black for easy reading.

("Draftette" is available from David Miller & Associates, Box 572, Beverly Hills, California.)
Circle 1589 opposite last page.

Oil switch stops inrush currents

Three-phase 400-amp oil switch limits high-frequency inrush currents from step-switching of capacitors. Switch is rated at 15 kv and 110 kv BIL. Switches may be used in systems with phase-to-phase ratings of 14.4 kv and below, and switch 300 amps capacitive current.

Switches can energize large



Resistors limit inrush currents

When the PRESSURE is on...

WILCOX Self-Sealing GASKETS HOLD

The greater the pressure, the tighter it holds. Nothing can beat this Wilcox Self-Sealing Gasket as proved in years of service.

The U-shaped metal outer cover is packed with a resilient filling (usually rubber or asbestos). Pressure exerted on the elastic filling forces it into the cover, putting force against the adjacent flange surfaces. Thus, pressures that tend to blow ordinary gaskets make the Wilcox tighter.

Available with covers of copper, lead, tin, aluminum, monel, stainless steel, etc., in all sizes, standard or special.

Write for Bulletin No. 569 and prices

CHICAGO-WILCOX MFG. CO.

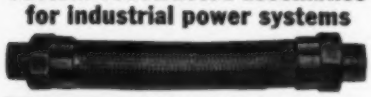
7725 South Avalon Avenue
Chicago 19, Illinois

Circle 1590 opposite last page

COBRA® FLEXIBLE

SEAMLESS METAL HOSE

Custom constructed assemblies for industrial power systems



All sizes in bronze, stainless or carbon steel, monel, inconel and low carbon nickel. Seamless spiral or parallel corrugation... Braided. All type of fittings and flanges welded, brazed or soldered. Also, interlocked hose.

write — wire — phone: RE 7-3311
...for prices and catalogs

COBRA METAL HOSE
5059 S. Kedzie Ave., • Chicago 32, Ill.

Circle 1591 opposite last page

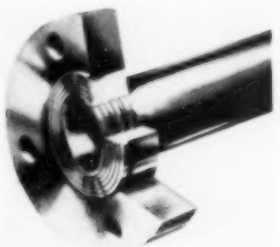
installations of capacitors in convenient blocks. Resistors limit magnitude of high-frequency transient currents from energized capacitors attempting to discharge to nearby de-energized capacitors.

(Three-phase 400-amp oil switch is available from Line Material Industries Div., McGraw-Edison Co., Milwaukee 1, Wis.)

Circle 1592 opposite last page.

Lightwall fittings give flexibility

Stainless steel serrated insert with carbon steel flange is designed for lightwall stainless steel piping systems. Insert permits changes in piping system that would be impossible with welded joints. Leak-proof connections are made by expanding pipe directly into insert flange. Flange is held to insert by a lip that allows flange to be pulled tight against gaskets.



Pipe expands into flange for leak-proof joint

(Stainless steel serrated insert is available from Speedline Div., Horace T. Potts Co., 504 Erie Ave., Philadelphia, Pennsylvania.)

Circle 1593 opposite last page.

Unit heaters have two-speed motors

Horizontal and vertical unit heaters are available with two-speed motors — high speed for quick heat up, normal speed for comfort maintenance. Heaters can be controlled individually or in groups by a single thermostat. Continuous tube construction

NEW... for the first time...

A GUIDE TO HELP YOU SELECT BETTER UNIONS

Here's a 16-page HANDBOOK that gives facts and tells...

THE IMPORTANT THINGS YOU NEED TO KNOW ABOUT UNIONS

PRESSURE-TIGHTNESS comes when the seats are properly mated. "What Makes a Good Union" tells you how this is done.

DURABILITY reduces service and operating costs . . . saves money. This new handbook gives you the facts on this.

These and other important features of good unions, such as safety in handling, speed in making up, and individual factory testing, are clearly illustrated and discussed in "What Makes a Good Union."

Clayton Mark pioneered unions — produced the first *steel* union, the first forged *stainless* steel union, the first handle-bar union, the first orifice union, and originated many features which today make unions so trouble-free, long-lasting, and economical.

The high points of this wealth of practical experience provide a liberal education in unions for contractors, piping superintendents, steam-fitters, maintenance men, and purchasing agents. "What Makes a Good Union" is a trouble-shooter's handbook and an excellent text book for training new men.

BE SURE TO WRITE FOR YOUR *FREE* COPY OF "What Makes a Good Union" so you'll have at your fingertips the useful, money-saving information contained in this easy-to-understand handbook.

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Since 1912
Originators and Manufacturers of STEEL UNIONS

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Please send FREE copy of "What Makes a Good Union."

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Town_____ Zone____ State_____

Circle 1594 opposite last page

Can be controlled individually or in groups

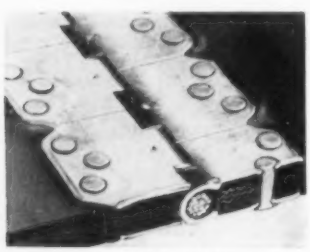
permits heaters to be used for hot water or steam (to 200 psi).

(Thermolier unit heaters are a product of Grinnell Co., Inc., 260 W. Exchange St., Providence 1, R. I.)
Circle 1595 opposite last page.

Quick splice for conveyor belts

Heavy-duty hinge-type splice for troughed conveyor belt eliminates need for templates, drilling, hole punching. Splice installs in one piece.

As conveyor operates, hinge plate separates into sections at pre-scored notches to con-



Splice goes smoothly even around small diameter pulleys

form with conveyor trough curvature. Gives close fit with tight yet flexible joint.

Splice is fastened with pointed rivets that do not cut and weaken belt fabric. Splice gives up to 68% of belt tensile limit.

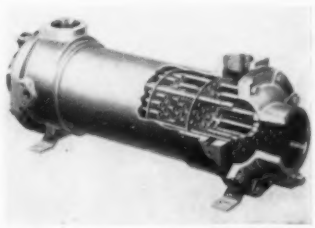
Adding and removing belt sections is quick with reusable cable pin. Splice fits belt from 3/16 to ¾ inches thick and up to 60 inches wide.

(Minet splice is a product of General Splice Corp., 85 Spring Street, South Norwalk, Conn.)
Circle 1596 opposite last page.

Exchanger has 124 sq ft of heat transfer surface

Pre-engineered standard heat exchangers come in 46 sizes with 1.2 to 124 sq ft of heat transfer surface. One-, two-, and four-pass designs available. Baffles with flanged lip at each tube hole and around outer edge give tighter tube fit.

Copper alloy core assembly



3-position movable feet give mounting flexibility

and cast iron bonnets are corrosion resistant. Hubs are relieved under connections for unrestricted flow.

Exchangers are suitable for process heating or for cooling lube oil, jacket water, hydraulic and other fluids.

(Type BCF exchangers are built by Ross Heat Exchanger Division, American-Standard, Buffalo 5, N. Y.)
Circle 1597 opposite last page.

Steam cleaner shoots 280 gph from guns

Heavy-duty steam cleaner is self-contained and fully automatic. Delivers 280 gph of balanced cleaning solution. Automatic controls regulate fuel to burner and water flow to coil.

Cleaner supplies 50 to 280

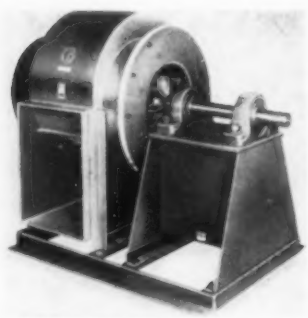
Steam cleaner is self-contained, automatic

gph solution from one or two guns singly or simultaneously. Accurate control of vapor delivery permits heavy-duty cleaning at distances of 3 feet or more.

(Blast-Master 280 is available from Clayton Manufacturing Co., 401 N. Temple City Blvd., El Monte, Calif.)
Circle 1598 opposite last page.

High-temp heat fans keep bearings cool

High temperature heat fans keep bearings cooler, thus eliminating many bearing troubles. A rotating member of dissimilar alloy, fitted to the shaft, radiates and circu-



Fan handles temperatures to 1650°F.

lates ambient heat away from bearings. Fans handle 600 to 30,000 cfm at temperatures to 1650° F.

(Dura-Temp heat fans are built by General Blower Co., 8611 Ferris Ave., Morton Grove, Ill.)
Circle 1599 opposite last page.

Aluminum bus bars rated 60% IACS conductivity

Commercially available for first time, aluminum alloy bus bars have guaranteed minimum electric conductivity of 60% IACS.

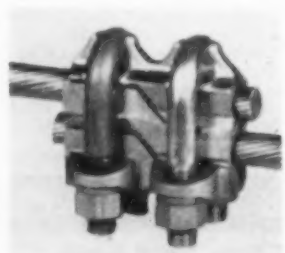
Tensile strength of new bus bars is 15,000 psi. Yield strength is 8000 psi, with excellent bending properties.

With increased minimum conductivity, designers can realize savings with smaller bus conductors, smaller power losses, or a combination of both.

(No. 2 EC-T64 aluminum alloy bus bar is made by Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.)
Circle 1600 opposite last page.

Parallel clamps made of high-strength aluminum

Parallel clamps come with one, two, or three aluminum alloy U-bolts to handle conductor sizes from No. 6 to 900MCM, ACSR. Each size



No galvanic action

holds aluminum, ACSR, or copper in either groove.

Wrap-around design keeps sides of center spacer always in contact with cap and bottom plate — forming metal wall that completely encloses conductor.

Heavy sections give reliable service on both aluminum and copper conductors with no danger of galvanic action. Mass anodic effect protects aluminum conductor from attack. Spacers (pure, soft EC aluminum) are acid-alkali etched and grease-coated for an oxide-free, clean metallic contact surface.

(Type ADC U-bolt parallel clamps are available from Penn-Union Electric Corp., Erie, Pa.)
Circle 1601 opposite last page.

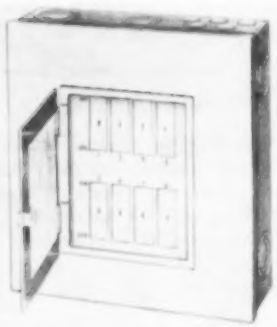
Load center will house 15 to 50-amp breakers

Circuit breaker load center houses 15 to 50-amp circuit breakers, single and double poles, or 15 to 20-amp switching neutrals.

Enclosure comes in indoor

or outdoor construction for 6 or 8 circuits. It is used for 3 wire services, solid neutral 100/240 volts ac.

With sequence bus design,



Breakers come in surface- or flush-mounting types

any two adjacent breaker positions may be double pole.

Enclosure for 8 circuits will take 1 to 8 single or 4 double pole breakers.

(E-Z-Red load center is manufactured by The Wadsworth Electric Mfg. Co., Inc., Covington, Ky.)

Circle 1602 opposite last page.

Cast stainless fittings for 2500 psi at 670°F

Cast stainless steel fittings for high temperature applications, including nuclear installations, are now standard in 8- to 30-inch tees, reducing fittings, and 45° and 90°

12-inch tee, standard in new line of stainless fittings

elbows. Fittings come in both 300 and 400 alloy series stainless steel.

(Standard stainless fittings are produced by Cooper Alloy Corp., Hillside, N. J.)

Circle 1603 opposite last page.

announcing

the most durably engineered turbine type pump yet built . . .

the NEW SCHAUB POWER PLANT Boiler Feed Pump

TWO-STAGE CENTER MOUNTED
1750 RPM
CAPACITIES to 150 GPM
PRESSURES to 300 PSI

Now—Get ALL the Advantages of a Turbine Pump —WITH TWICE THE PUMP LIFE!

- Improved head range and NPSH characteristic of turbine pumps.
- Exclusive, super-hardened, triple-life impellers.
- New "over-strength" case, shafting and bearings.
- Less maintenance, easier servicing.

Exclusive
DuraHard® Electrolized Impellers

A super-hard (1100 Brinnel) "skin" of dense, non-magnetic alloy resists wear, corrosion and erosion. Will not chip, peel or spall. When, or if it eventually wears through, the base metal in its original dimension still has normal service expectancy! Electrolizing also relieves impeller of stresses set up during forming and machining . . . Increases impeller life up to 300%.

Now, for the first time, you can specify or design a boiler feed system offering the advantages and better head characteristics of the turbine pump—*and get maximum pump life, too!*

The new Schaub Power Plant Pumps are "over-strength" in all components. Double-row, pre-lubricated ball bearings are oversize for a wider margin of safety. Newly improved Schaub Flexi-matic Seals permanently end packing problems, scored shafts, lubrication wash-out and seal leaks. Heavy-duty housing and bearing arms keep pumps "in line" and prevent warpage. Low stuffing box pressure doubles shaft seal life.

In short, we believe that in Schaub Power Plant Pumps you now have available to you the most trouble-free turbine pump ever built! Even its minimum maintenance needs have been made easier, quicker . . . and inexpensive.

Schaub Power Plant Pumps are one more good reason for specifying Schaub Boiler Feed Systems. *It will also pay you to specify them for individual pumps and replacements.*

WRITE FOR NEW BULLETIN No. 65 ● Get the full facts on this new major break-through in turbine pump design. Technical data, pump "lore", specifications, dimensions and capacity ratings. A must for consulting and power engineers.

FRED H. SCHAUB ENGINEERING COMPANY
2115 S. Marshall Boulevard, Chicago 23, Illinois

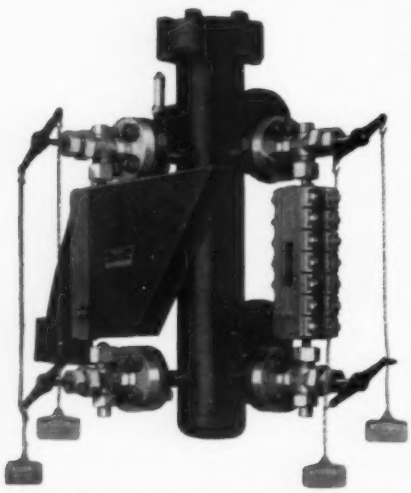
Circle 1604 opposite last page

Reliance Boiler Safety Equipment is a profitable investment for your power plant

Don't overlook the relatively *small* equipment that keeps the *big* equipment running smoothly. Reliance Safety Devices are mainly applied to boiler water level supervision, but the well-being of your boilers affects other "big" equipment, as you know. So the selection of high grade accessories for the boilers is of major importance.

Water Columns and Gages are basic equipment you must add to your boiler when installed, or order with it from your boiler maker. Reliance offers you complete service in approved devices for water level supervision, including extra alarm devices that help insure attention of operators if a dangerous water level situation threatens. Reliance representatives in all major cities are ready to help you at any time.

The Reliance Gauge Column Company
5902 Carnegie Ave., Cleveland 3, Ohio



Water Columns for all pressures, with or without alarms.

Water Gage Valves

Gage (try) Cocks

Gage Inserts

Direct-to-Drum Gage Assemblies

Water Gage Illuminators

EYE-HYE Remote Reading Water Level Indicator

Float-type and Electrode-type Liquid Level Alarm Devices

The name that introduced safety water columns....in 1884

Reliance®

BOILER SAFETY DEVICES

Circle 1605 opposite last page

Six-port transfer valve keeps flow constant

Valve is designed to maintain continuous, even flow of fluid during transfer from one unit to another. Possible applications: duplexing two strainers, heat exchangers.

Six-port valve has common inlet and outlet. Flow is through single inlet to either of two pieces of equipment, and out through common discharge connection.

Single operating handle jacks up plug before rotation. Plug cannot be rotated until it is clear of seat.

(Type 45 transfer valve is a product of A. W. Cash Co., Box 551, Decatur, Ill.)
Circle 1606 opposite last page.

Fused relays nix overload threat

Fused mercury plunger relays give positive protection against overload in motor controls, lighting controls, heater power, refrigeration equipment, welding tools. Hermetically sealed mercury-to-mercury contacts keep out dusty, dirty, moist, and corrosive atmospheres.

Fused relay contacts are hermetically sealed

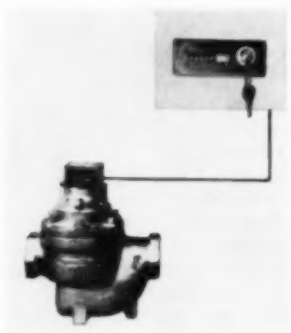
Relay handles loads to 35 amps at 115 volts ac. Other relays of two- and three-pole construction handle loads to 60 amps at 115 volts ac.

(EMF-1 Relay is available at Ebert Electronics Corp., 212-31 W. Jamaica Ave., Queens Village 28, N. Y.)
Circle 1607 opposite last page.

Liquid meter counter is remote-controlled

Vortex-type liquid meter has an electric counter that can operate by remote control. Counter can be mounted in control panel or in any handy spot.

Counter size (5½ by 2 inches) permits installation in tight places. Meters have vertical or horizontal dials. White numbers, ¼ inches high, appear on black background of dial for easy reading from a distance.



Counter is small, easy to read

Meter measures accurately regardless of liquid temperature or gravity — can be used for many different processes.

(Remote control counter is available from Henszey Co., Watertown, Wis.)
Circle 1608 opposite last page.

Zipper tubing easy to install, remove

Flexible tubing with zipper fastener provides a shielded casing for multi-conductor wiring or cables. Tubing is plastic-saturated fiberglass backing laminated to aluminum, lead, or magnetic foil.

Laminated metal foil may be used for grounding RF and UHF. Tubing comes in ⅜-inch I.D. and larger in increments

Laminated metal foil lines flexible tubing

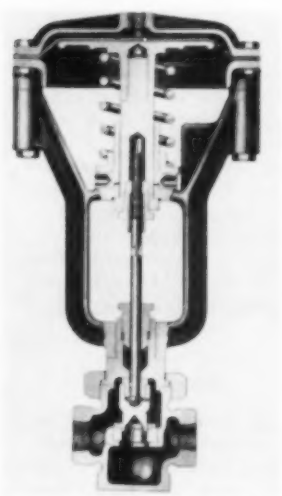
of ⅛ inch and in wall thicknesses of 20, 40, and 60 gauge.

(Zip flexible tubing is a product of Zippertubing Co., 750 S. San Pedro, Los Angeles, California.)

Circle 1609 opposite last page.

Diaphragm valves give accurate control

Diaphragm-operated valves give accurate instrument-actuated control of temperature, pressure, flow. Available for direct or reverse action, valves



Design gives precise modulation

handle steam, air, liquid, or gas to 250 psi.

Valve body, yoke, and top are bronze; stem is corrosion-resistant K-monel. Cast Stellite V-port disc and Stellite-faced K-monel seat eliminate wire drawing or cutting.

(Diaphragm-operated valves are a product of Sinclair-Collins Valve Co., 454 Morgan Ave., Akron 11, O.)

Circle 1610. ♦

Higher Voltage Distribution Reduces Costs

This is best accomplished in new buildings and modernization projects, by installing SORGEL dry-type transformers at load centers, using higher voltage feeders.

ALL Sorgel dry-type transformers are so quiet that they can be installed in any convenient place, thus assuring the most efficient distribution, best voltage regulation, and lowest wiring cost — in institutional, commercial and industrial buildings.

COST LESS TO INSTALL, because they are all self-contained in a single unit — either single phase or 3-phase — equipped with substantial wall brackets or floor mounting base. No separate brackets to make or buy. Easily accessible, roomy connection compartment, with wide choice of knockouts. Solderless terminals.

LIBERAL DESIGN, HIGH EFFICIENCY. SORGEL dry-type transformers are guaranteed to carry their full rated load continuously at high efficiency. They are so liberally designed that they can carry an overload during an emergency at a safe operating temperature. Vacuum impregnated windings brazed to solderless terminals assure years of trouble-free service.

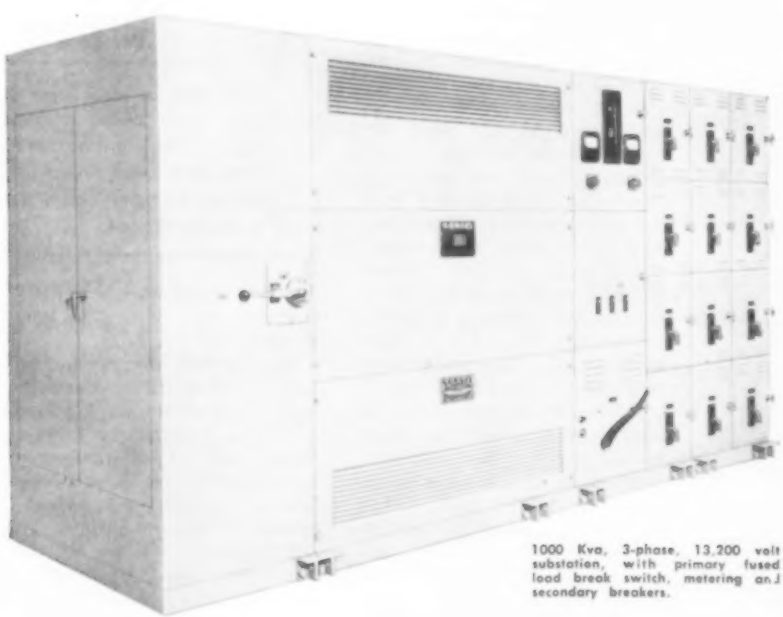
Available in all standard and intermediate ratings and voltages, ¼ to 3000 Kva, and from 120 volts to 15,000 volts.

15 to 50 Kva 3-phase, 480 to 208Y/120 volts. Wall mounting transformer. Connection compartment panel removed.

Substation transformers

The same quiet Sorgel transformers, in ALL ratings up to 3000 Kva and up to 15,000 volts, are also incorporated in substations. Procurable with any type or make of switchgear, or from any substation manufacturer.

Sales engineers in principal cities.
Consult the classified section of your telephone directory or communicate with our factory.



1000 Kva, 3-phase, 13,200 volt substation, with primary fused load break switch, metering and secondary breakers.

SORGEL TRANSFORMERS

SORGEL ELECTRIC CO., 841 West National Avenue, Milwaukee 4, Wisconsin

40 years' experience in the development, manufacturing and application of transformers

Circle 1611 opposite last page

POWER BASICS FOR TODAY'S INDUSTRY

Fluid mechanics—VIII

PARAMETERS AND MODELING

By **JAMES M. ROBERTSON**
Professor of Theoretical & Applied Mechanics
University of Illinois

Last month Power Basics explored similarity parameters and their uses. One method of determining such parameters makes use of dimensional analysis. Now let's look at some of the pitfalls in using this method to arrive at meaningful dimensionless parameters — and go on to the use of models and analogs.

Dimensional analysis is dangerous ground for the inexperienced. Although other methods of obtaining dimensionless parameters are available, the procedures are complicated. This last part of this Power Basics series discusses these methods and their value. It also discusses the uses of modeling studies and their modern counterpart — the analogy.

This dimensional analysis method has a serious drawback — you learn nothing new. If not enough, too many, or the wrong variables are introduced at the start, the result will be of little value.

Dimensional analysis does assist us by indicating how many independent dimensionless parameters are possible for a given problem. It also shows that we have a number of alternate, equally suitable, parameters. Thus, the problem of friction loss in smooth pipe involves variables h_f, L, D, V, g,ν. The Pi-theorem tells us that these six variables must be related by three dimensionless parameters, which might be $h_f g/V^2$, L/D, VD/ν.

Experience and a certain amount of rationalization suggest combining the first two into a friction factor $f = h_f D/L V^2/2g$. We find experimentally that all our knowledge of friction in smooth round pipes may be presented as a relationship between f and $\mathbf{R} = VD/\nu$.

However, we could easily have arrived at other fundamental, although less well known, parameters which we previously called **S** and **T**. It was shown that either of these parameters could be used for presentation of our information on f, and that for some "indirect" problems, one or the other was more suitable than Reynolds number.

Two other methods of obtaining the necessary similarity parameters are available. One involves writing the basic differential equations characterizing the pertinent flow phenomenon.

Even though we may not be able to solve these equations — and we often cannot — we can easily derive from them a proper set of dimensionless parameters to use in summarizing or planning our experimental or modeling work.

Since most of us are not too adept at setting up our problem in terms of differential equations, we resort to the other and simplest method for obtaining a set of similarity parameters.

This elementary method might be called inspectional. It is based on experience but requires little more knowledge and experience than is needed to choose the proper variables for dimensional analysis.

As soon as we know that viscosity is going to affect the problem, we know that a Reynolds number will appear.

The only question, then, is what velocity and what length variable should be utilized — and this can be decided only by experience. Often, the necessary experience is obtained only during experimental study of the problem.

The inspectional method of obtaining the proper set of dimensionless similarity parameters involves consideration of parameter lists such as those in figs. 3 and 4 (page 21 of February POWER INDUSTRY).

Major decision is what fluid properties may enter into the problem — and here some physical intuition is most helpful — and what information is expected of the answer.

One general type of similarity parameter has not been included in figs. 3 and 4. This is the geometric parameter, needed to describe the shape of the body concerned.

Such parameters usually appear as length ratios or angles. Thus, studying flow in an air duct diffuser involves the aspect ratio or length-width ratio of the duct cross section and the diffuser angle. This is the ratio of its length in the flow direction to the width of the cross section.

Air forces on a billboard depend not only upon Reynolds number, but upon the proportions of the board (length-width or aspect ratio) and the angle it makes with the wind.

Such geometrical parameters are self-evident as well as innumerable. Just be careful to include no more than the minimum number required to describe the shape and attitude of the body or configuration.

Modeling

Using models to solve or help understand flow problems has become a very important part of fluid mechanics technological effort. This is evident to anyone who has visited, if only through the medium of a magazine article, any large research establishment.

To the uninitiated, effort devoted to models may appear to be nothing but "organized play for adults", but it has methodology (being based on similarity) and great value. And this value is spelled with a dollar sign.

A small "model" test may

avoid a costly error, or it may indicate a much improved design or method of avoiding a problem. In the design of large hydraulic structures, model tests are often used as a direct step in the design, i.e. as a design tool. Of course, model studies can be very misleading if improperly applied.

Application of model studies to elucidation, if not solution, of fluid mechanics problems is based on similarity. To have mechanical similarity between the motions in our "model" and those in the prototype, we must have both geometric and dynamic similarity.

In some instances, an experimental study may be hamstrung by an attempt to make it a model study.

A generalized study of the various parameters involved would lead to information for solving many problems beside the specific prototype one. And in the case of the specific prototype, the result of the generalized study will permit a freer ultimate design.

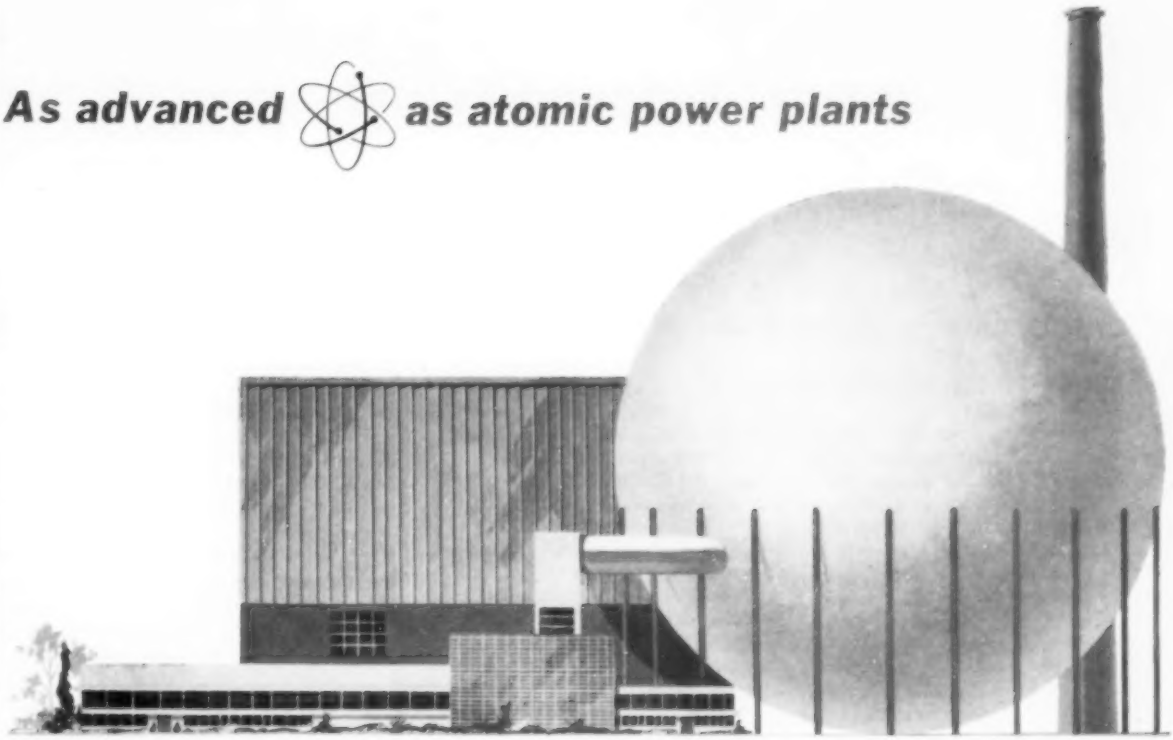
Model tests should only be carried out when the problem is so intricate that research into the phenomena involved does not promise a reasonably quick solution.

Another kind of a "model" used in solving fluid flow problems is the analogy. This involves modeling the flow problem in a different physical system — usually electric.

We may use an electric network analyzer as for pipe distribution systems, an electrolytic analogy, or an analog computor (for water hammer or hydraulic control systems). ◆

"I still can't understand how you beat me every game!"

As advanced as atomic power plants



INFILCO ION EXCHANGERS

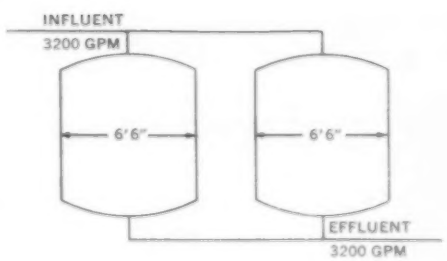
treat boiling water reactor condensate at

50 GPM PER SQUARE FOOT

Two 6'-6" diameter mixed bed demineralizers with a total surface area of 64 sq. ft. are now being installed to handle 3,200 gpm of reactor condensate. These units will produce polished condensate with a conductivity of approximately 0.1 micromho in a fraction of the space and at much lower installation cost than conventional equipment.

The plant design is based upon extensive pilot plant studies using a 24" diameter unit to treat unfiltered condensate at 200 gpm (68 gpm per sq. ft.). The equipment and techniques developed for this plant are also applicable to high pressure conventional and super-critical pressure plants.

Results of pilot plant studies and design features of this ultra-modern installation will be sent free upon request. Write today for Reprint #88.



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THE ONLY COMPANY impartially offering equipment for ALL types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

Circle 1612 opposite last page

NEW LITERATURE

Reviews of books and industrial bulletins describing equipment, supplies, services

Supervisory control — how it can help you

Bulletin gives the what, why, and how of supervisory control equipment. Such equipment can control and supervise any electric apparatus that is set up for local control. Functions range from opening and closing switches and valves to adjusting speed, voltage, or load. Initial purchase and installation cost is low — only one pair of controlling wires or one communication channel is needed.

(Direct wire control systems use up to five wires for each piece of controlled equipment.)

Gives data on types of supervisory control equipment available. Installation and operating details included. Photographs show how supervisory equipment controls pumps and valves, supervises traffic, controls power distribution, and controls and telemeters pipelines and offshore pumping.

(Bulletin GEA-6603, 16 pages, is available from General Electric Co., Shenectady 5, N. Y.)
Circle 1613 opposite last page.

Get physical data on transformers

Engineering manual gives physical data on four series of dry-type distribution transformers: 1) 3 to 10 kva, class H insulation; 2) 15 to 112½ kva, class H insulation; 3) 3 to 112½ kva, class B insulation with silicone impregnation; and 4) 150 to 500 kva, class B insulation.

Data includes dimensions, cable connector sizes, voltage ratings and taps, standard accessories.

(Bulletin 137 is available from R. E. Uptegraff Manufacturing Co., Scottdale, Pa.)
Circle 1614 opposite last page.

Easy way to duplicate records, documents

Bulletin reviews photocopy equipment that duplicates printed material and pen, pencil, or crayon copy in minutes. Special features make possible copies on card stock to fit card files, two-sided copies or four-page copies, translucent printing master copies, and offset master copies.

(Bulletin F1-106 is available from Eastman Kodak Co., Business Photo Methods Div., Rochester 4, N. Y.)
Circle 1615 opposite last page.

Bin level indicators improved three ways

Bin level indicators now have three added features: new cover that twists on and off quickly; vented housing to avoid pressure build-up with flexing of diaphragm; and simplified diaphragm assembly.

Bulletin gives data on bin level indicators, including indicators for hazardous atmospheres and indicators with aerator unit to keep bulk materials moving.

(Data on Bin-Dicator, Roto-Bin-Dicator, and Bin-Flo are available from The Bin-Dicator Co., 13946-V2 Kercheval, Detroit 15, Mich.)
Circle 1616 opposite last page.

For cleaner air, heat recovery

Catalytic oxidation systems for industrial air pollution control and heat recovery are described in new 8-page bulletin.

Four case histories show how installations are used in organic finishing and drying, chemical processing, oil refining, and food processing. Systems permit almost 100% cleanup of combustible contaminants.

(Bulletin on Oxycat systems is available from Oxy-Catalyst, Inc., Wayne, Pa.)
Circle 1617 opposite last page.

"By the way — did they ever catch Jonesie?"

Valve controls fuel flow to oil-fired boiler

Technical data sheet describes adjustable cam, lever-operated valve for accurate metering of fuel oil to burner. Valve maintains set ratio between two variables, such as air and fuel oil, for accurate metering. Operating features, recommended uses, construction details are given.

(Data sheet on Fig. 235-1 control valve is available from Atlas Valve Co., 280 South St., Newark 5, N. J.)
Circle 1618 opposite last page.

Removes moisture from air lines

Aftercooler system gives cool, clean, dry air for safe operation of air-operated tools, instruments and controls.

(Data Sheet 2568 gives details. Jas. A. Murphy & Co., Inc., 1419 E. High St., Hamilton, Ohio.)
Circle 1619 opposite last page.

20-amp switches for accurate control

Instrument and control switches for circuit breakers, transformer tap changers, motor-operated rheostats, and other electrically controlled apparatus are described in 8-page bulletin.

Switches are rated for 20-amp continuous capacity with 600 volts insulation. Bulletin gives data on components, ordering specifications, installation. 8 pages.

(Bulletin 14B8112A is available from Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.)
Circle 1620 opposite last page.

For more information on items reported in the New Literature section, circle corresponding numbers on reader service card opposite last page.

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MARIETTA CONCRETE SILOS

Whatever materials you handle . . . powder form to 16" lumps . . . you can realize a big savings in time, labor and money with a MARIETTA storage system designed to your operation.

Marietta silos are economically erected in any desired capacity . . . any number of units. Interlocking concrete stave construction provides safe, dry storage . . . resists wind, shock or fire . . . requires a minimum of maintenance.

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41 Years Know-How in Pre-Cast Concrete Construction
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Circle 1621 opposite last page

High-capacity drives need less space

Bulletin describes new line of heavy-duty speed reducers and load-supporting flexible couplings for driving heavy rotating machinery at low and medium speeds.

Parallel shaft and right angle units are available in ASMA ratings to 1500 hp. Drives are designed for extra capacity in proportion to space occupied.

(Bulletin UD-5801 is available from The H. W. North Co., PO Box 9051, Birmingham 9, Ala.)
Circle 1622 opposite last page.

Makes inspection easy

Entire operating element of float-thermostatic steam trap can be removed for inspection and maintenance without disturbing inlet and outlet connections. Two-page bulletin lists construction features, gives size and capacity charts of models in line.

(Bulletin 455-B is available from Sarco Co., Inc., 635 Madison Ave., New York, N. Y.)
Circle 1623 opposite last page.

Colored coatings protect municipal sewage works

Inertol Protective-decorative coatings for municipal and industrial sewage works maintenance painting are described in bulletin. It includes complete specifications on coating and maintenance painting chart.

(Bulletin 25-C, 4 pages, is issued by Inertol Co., Inc. 480-490 Frelinghuysen Ave. Newark 12, N. J.)
Circle 1624 opposite last page.

Provides dimension data for sand, slurry pump

Four-page bulletin describes pumps for heavy-duty pumping of sand, slurry, gritty water, and abrasive pulps. Special features include wear-resistant, interchangeable liners of hard metal or rubber.

(Bulletin 601 is available from Krogh Pump & Equipment Co., Inc., 515 Harrison St., San Francisco 5, Calif.)
Circle 1625 opposite last page.

Water treatment systems guide

Bulletin of 24 pages discusses conditions that make water treatment necessary and lists chemical reactions frequently encountered. Common problems reviewed are silica reduction, foaming, priming, corrosion protection.

("Hot Process Softeners" bulletin is available from Cochrane Corp., 17th St., Philadelphia 32, Pa.)
Circle 1626 opposite last page.

Lists approved data on Douglas fir crossarms

One of continuing series on various materials used in line construction, bulletin covers industry specifications for heavy-duty Douglas fir crossarms.

Data covers dimensions, quality of lumber, moisture content, manufacturing requirements, marking and coding, preservatives, inspection techniques.

(Bulletin TD-92, 12 pages, Edison Electric Institute, 420 Lexington Ave., New York 17, New York.)
Circle 1627 opposite last page.

Full-float couplings need no maintenance

Describes full-floating shaft couplings that may be used to connect shafts that are spaced far apart. Recommended for cooling tower drives; fan, pump, and compressor drives; high-speed blowers and compressors.

Coupling features include freedom from backlash, ability to compensate for angular and parallel misalignment.

continued on page 30

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The manufacturer of an ACID CLEANER who displays this label on his product indicates he is using the finest Corrosion Inhibitor available.

For complete information on O'B-HIBIT and a list of manufacturers in your area who display this label, write:

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Address .....

Circle 1628 opposite last page

RAMBLINGS ON INSTRUMENTATION

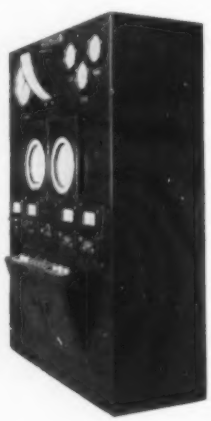
One good package deserves another

The trend to pre-assembled or "packaged" products has spanned everything from cake mixes and frozen TV dinners to naturally enough, boilers.

In step with the supermarket trend in the power field, Hays manufactures "instant" controls, completely pre-assembled and packaged and ready for use with your new package or field-assembled boiler. A wrench and a handy a-c outlet are just about all you need.

The packaged controls we make are designed specifically to deliver the economy you hoped for when you invested in a new boiler. We manufacture these electric automatic controls in ten different systems, each of which is sympatico with a particular boiler type.

Hays electric control packages are complete. Controllers, instruments, switches, valves, strainers, regulators, egg yolks . . . everything is in position. Installation is simple, but if you're all thumbs, a service man of your local Hays representative is available to help with installation and start-up.

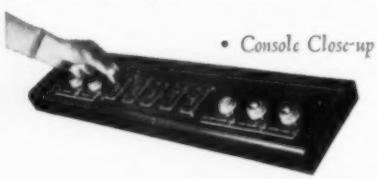


• *Packaged Control Panel*

Hays control systems possess more virtues than you could reasonably expect from their flesh-and-blood counterparts in the human race: sobriety, patience, alertness, stamina and all that. Yet they demand nothing from Man save an occasional swipe with a dustcloth and an affectionate pat.

Undistracted by the superintendent's blond secretary or World Series pools, they concentrate on what's going on inside the boiler. They automatically modulate the boiler from maximum to minimum load at peak efficiency, and even to low load on-off operation. As required, they will take a boiler in or out of operation safely and automatically.

Switches and indicating lights are grouped neatly on a handsome console set at keyboard height (see keyboard and well-manicured hand below) with enough room left over for a brace of candelabra—if you like atmosphere in the boiler room.



• *Console Close-up*

Your consulting engineer will usually recommend that you place the responsibility for providing controls with a control manufacturer, rather than the boiler manufacturer. This makes sense. It affixes the responsibility for safe, efficient control where it ought to be and relieves everyone concerned of a potential king-size headache.

Whaddaya know? Premiums!

In a moment of sheer madness, we bought some miniatures of our packaged controls designed for use as banks. Idea was that this gets across the association of Hays controls with economy. Well, anyway, we have them. You might like one for your kids or yourself. Ask for a couple and make our ad manager happy. He sometimes gets pensive wondering "does anyone *read* all that copy?"

For a prose treatise on our complete line of Electric Packaged Control Systems, drop me a hint that you'd like our bulletin 57-1088-239, just off the press.

Paul Sprague Jr.

President

THE HAYS CORPORATION • MICHIGAN CITY, INDIANA

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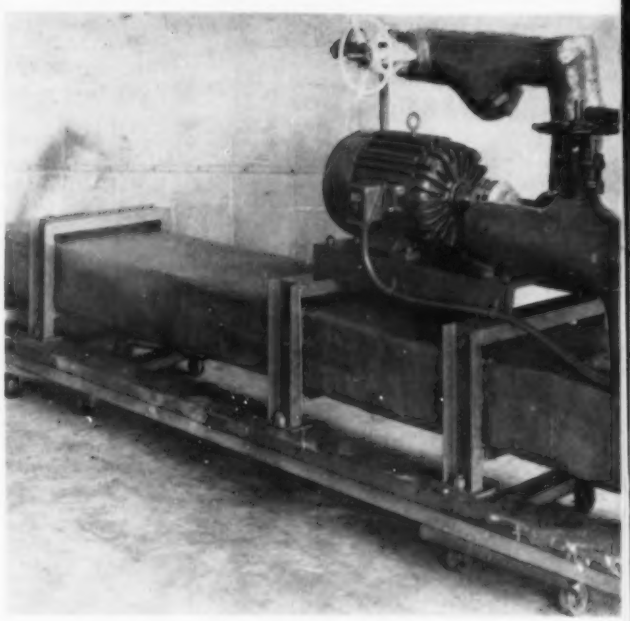


Need a portable heat source?

Move this heater from

Portable electric heat transfer unit, installed at the Budd Company's Philadelphia plant, heats cast steel molds for molding plastic rings. Unit, moved on a standard industrial hand truck, serves a number of molding presses, replaces steam-heated molds.

The 7-foot long by 3-foot wide by 4½-foot high unit has a capacity of 30 kw and maintains the molds at 400 to 450 F. Light heat-transfer oil, made by Socony-Mobil Oil Company, is used as the heating medium. Oil is pumped continuously through the molds from the heating unit through flexible piping. These new multi-pass electric heaters are designed to maintain a low rate of heat input and high velocity of the heat transfer medium.

Package heaters are built around a patented heating tube, developed by Hynes Electric Heating Division, Turbine Equipment Company. Heating tube consists of an electric heating element placed inside a round steel pipe. The round pipe is placed inside a seamless square steel duct. Baffles are welded to two opposite corners of the square pipe along its full length and form two passages in each tube for heating oil flow. Oil makes two passes in each heating tube.

Heating tubes are made in standard 5- and 10-foot lengths of 6 kw and 12 kw capacities respectively. Package units can be furnished in multiples of 6 kw up.

Package units consist of one or more multi-pass heating units, assembled in a horizontal position. Oil is pumped from bottom to top to prevent air entrainment when filling the system. All electric connections and controls are accessible at one end. Heating elements can be removed for inspection without disturbing piping containing the heating oil and without draining the system. If the heat load should decrease, one or more elements can be disconnected.

Package unit includes a positive displacement pump with

Packaged heater ready for installation. This unit has 10-ft. long heating tubes.

job to job

motor, thermostatic control, instrumentation, piping, expansion tank (for separate mounting) and a welded steel platform and frame.

To place unit in operation, electric connections are made and the heating oil circuit is connected to the vessel to be heated. Expansion tank is mounted and piped to the plugged connection in the unit. Pump and heating elements are electrically interlocked to prevent damage to the heating element if pump fails.

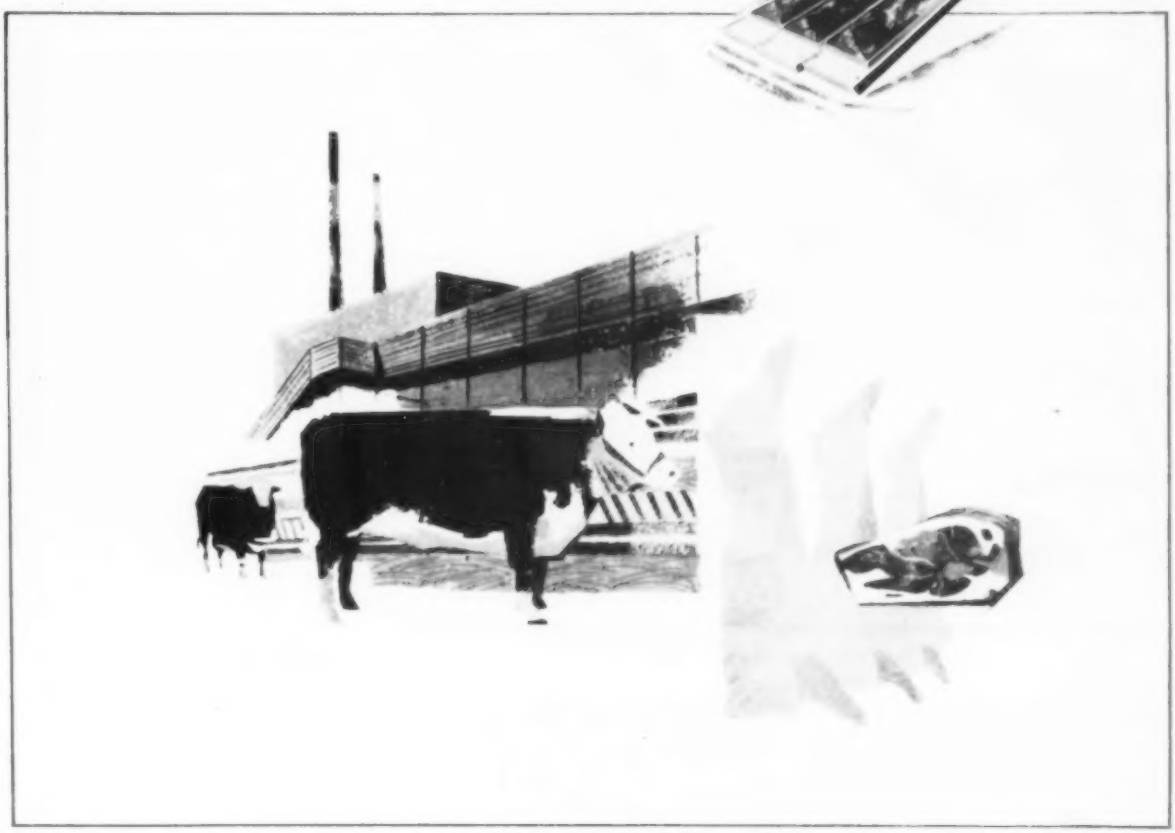
Licensed operating engineers are not required to operate the units. Although high temperatures can be obtained, operating pressure is only 15-30 psi.

Low heat input rate and high velocity of heat-transfer medium reduces decomposition of the heat-transfer medium to a minimum.

(Portable electric heat transfer unit is manufactured by Hynes Electric Heating Div., Turbine Equipment Co., Mountainside, N.J.)

Circle 1630 opposite last page.

MEAT PACKING



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United Electric pioneered the all-water route which now makes huge tonnages of coal available by low-cost transportation to public utilities and industries on the Inland Waterways and at Great Lakes Ports. This new economical coal distribution service offers you important benefits. The United Electric Representative will be glad to give you full information.

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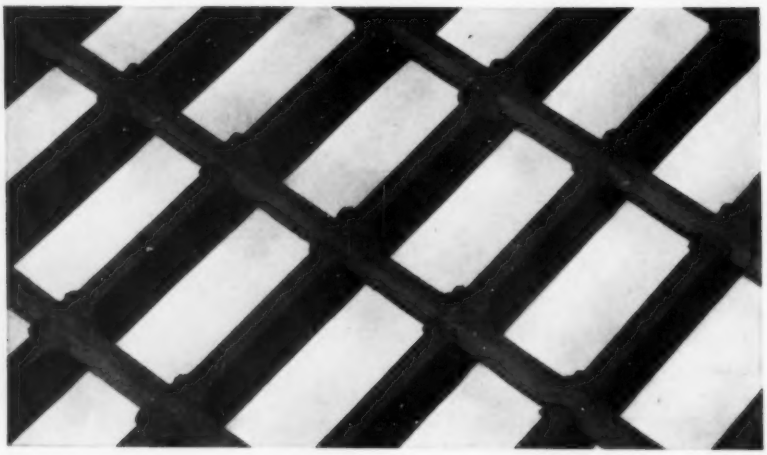

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One piece construction with tops of all bars flush provides safer, longer-lasting open steel flooring. And it's tailor-made to fit your requirements. For typical installations and full details on Gary gratings, stair treads and decking, write for Catalog MR-38.

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Circle 1632 opposite last page

BOILER TUBE COMPANY OF AMERICA
McKEES ROCKS, PA. (Pittsburgh District) Federal 1-7750

Circle 1633 opposite last page

NEW LITERATURE

continued from page 27

Concentricity is maintained without pilot bearings.

Couplings need no maintenance or lubrication; can be inspected while in operation.

(Bulletin 98, 4 pages, is available from Thomas Flexible Coupling Co., Warren, Pennsylvania.)
Circle 1634 opposite last page.

How to judge, select control valves

Six-page bulletin gives data on selecting correct temperature control valves for any application. Includes information on selecting proper valve material, valve trim, thermal systems.

(Bulletin 655 is available from Jordan Industrial Sales Div. of OPW Corp., 6013 Wiehe Rd., Cincinnati 13, O.)
Circle 1635 opposite last page.

Air conditioners boost central unit output

Sixteen-page bulletin describes inductor air conditioners that recirculate conditioned air from central air conditioners for individual room temperature and humidity control in hard-to-cool areas. Bulletin gives full installation and operating data on inductor units.

(Bulletin 8827 is available from American Blower Div., American Radiator & Standard Sanitary Corp., Detroit 32, Mich.)
Circle 1636 opposite last page.

For dc power supply

Bulletin describes industrial rectifiers that provide dc power for cathodic protection, battery charging, motor control, magnetic devices. Selenium, germanium, and silicon rectifiers are available for specific applications.

(Four-page Bulletin IR-1 is issued by Rapid Electric Co., 2881 Middletown Rd., Bronx, New York 61, N. Y.)
Circle 1637. ◆

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Circle 1638 opposite last page

PENBERTHY ILLUMINATORS
FOR LIQUID LEVEL GAGES

No Glare

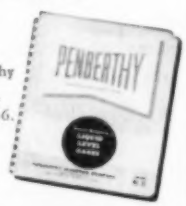
Clear Illumination of Liquid Level

Penberthy explosion-proof, dust-tight illuminators . . . with clear, plastic wedge . . . distribute bright EVEN light along entire length of gage glass. Rear lighting makes liquid level stand out sharp and clear. Accurate readings are easier from all angles and longer distances.

Explosion-proof illuminators can be installed on gages now in service, or on new gage installations. Available in single and double sections; for gages with three or more sections, order combinations of both . . . specify gage size or length of visible slot.

Standard 25 watt bulb and electric wiring housed in aluminum casing. Adjustable brackets permit easy installation to gage cover. Approved by U.L. for electric lighting fixtures used in hazardous locations for Class 1, Groups C and D service.

For information on the complete line of Penberthy gages, valves, and accessories, WRITE for NEW Catalog #36. Dept. A



PENBERTHY

PENBERTHY MANUFACTURING CO.
Division of Buffalo-Eclipse Corporation
1242 Holden Ave., Detroit 2, Michigan

Circle 1639 opposite last page

Rickover

continued from page 11

most high school graduates) and who then takes two years of liberal arts in college is, in effect, precluded from becoming a physicist.

And yet, in today's rapidly changing technological civilization, it is absolutely essential that the educational system be sufficiently elastic to permit students to study for those professions most needed at any given moment.

One Workable Plan

Prussia was one of the first countries to recognize that a modern state must have a citizenry with at least an elementary education. That she must have leaders sufficiently educated to deal with the problems of the coming industrialization. Other European countries also adopted the basic principles of this system. These are:

First, that elementary, secondary, and university education be devoted solely to developing the student's intellect to his greatest capacity. All vocational training must be done in special schools set up for the purpose.

Second, that the secondary schools give a broad general education in the shortest possible time, so that professional study can begin no later than *age 18.* This was necessary both for economy and to find time for compulsory military training.

Third, to get youngsters ready for professional study at age 18, serious study of foreign languages, higher mathematics, literature, geography, and history must begin no later than age *nine*, at which time the fast learners begin to be separated from the slow learners.

Fourth, to complete this broad general education in nine years requires carefully thought-out courses for each subject, advancing in logical sequence, from the simple to the complex.

Elective subjects can have no place in such a comprehensive and well-balanced program. Only at university level is selection of subjects

continued on page 33

responsible steam plant operators!

DON'T OVERLOOK THE ADVANTAGES WITH...

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Heat Exchangers

- Engineered to fit your needs.
- Savings in heat recovery quickly pay for equipment.
- Simplicity and economy of design.
- Built to last for years and years.

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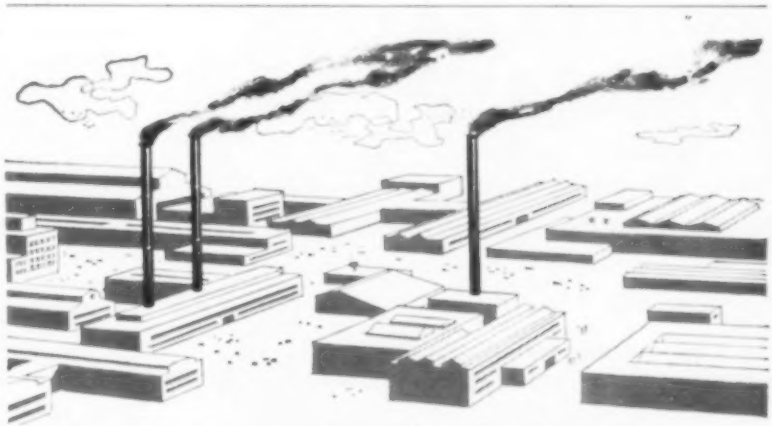

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CORPORATION

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A DIVISION OF
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

Circle 1642 opposite last page

Bring power plant cost estimates up-to-date

In December 1956, POWER INDUSTRY published a quick, graphic method for estimating power plant costs. This utilized two nomographs; one to help you estimate boiler plant costs, and one for steam-electric plant costs. Both involved a location factor, to adjust for labor, materials, overhead, and profit in your vicinity.

The method aroused a lot of interest, judging by the volume of requests for extra copies. So much so, that POWER INDUSTRY's editors thought it worthwhile to bring the nomograph up-to-date and in line with this year's increased costs.

The increase in construction cost indices follows the one-year trend (July 1, 1956 to July 1, 1957) established by Whitman Requardt & Associates (Handy-Whitman Index).

Note that construction costs, for plants outside the immediate vicinity of locations shown, must be adjusted for differences in local freight and labor costs.

area	location factor	area	location factor
Albany, Schenectady, Troy, N. Y.	1.09	Miami, Fla.	1.11
Albuquerque, N. M.	1.08	Milwaukee, Wis.	1.06
Atlanta, Ga.	1.02	Newark, Elizabeth, Jersey City, N. J.	1.21
Baltimore, Md.	1.03	New Haven, Conn.	1.13
Birmingham, Ala.	1.00	New Orleans, La.	1.06
Boston, Mass.	1.14	New York City, N. Y.	1.20
Buffalo, N. Y.	1.10	Norfolk, Va.	1.03
Chicago, Ill.	1.12	Omaha, Nebr.	1.13
Cincinnati, Ohio	1.07	Philadelphia, Pa.	1.08
Cleveland, Ohio	1.14	Phoenix, Ariz.	1.21
Columbus, Ohio	1.05	Pittsburgh, Pa.	1.08
Dallas, Texas	1.14	Rochester, N. Y.	1.12
Denver, Colo.	1.20	Rock Island, Moline, Ill.	1.07
Des Moines, Iowa	1.14	St. Louis, Mo.	1.14
Detroit, Mich.	1.15	Salt Lake City, Utah	1.17
El Paso, Texas	1.14	San Antonio, Texas	1.08
Houston, Texas	1.13	San Francisco, Calif.	1.20
Indianapolis, Ind.	1.07	Savannah, Ga.	1.01
Jackson, Miss.	1.02	Seattle, Wash.	1.22
Jacksonville, Fla.	1.01	Spokane, Wash.	1.20
Kansas City, Mo.	1.11	Springfield, Ill.	1.09
Los Angeles, Calif.	1.17	Tulsa, Okla.	1.12
Memphis, Tenn.	1.01	Washington, D. C.	1.10

Rickover

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left to the student.

Fifth, three basic types of secondary schools gradually evolved and are now provided —the classical, the semi-classical, and the mathematics-scientific. Each type provides a broad enough general education to permit the student to take almost any professional university course.

For example, a graduate of the classical secondary school can become an engineer by taking additional mathematics and science courses.

Sixth, considerable latitude is allowed in each school as long as national standards are met. These standards govern the qualifications of teachers and the competence of the graduates.

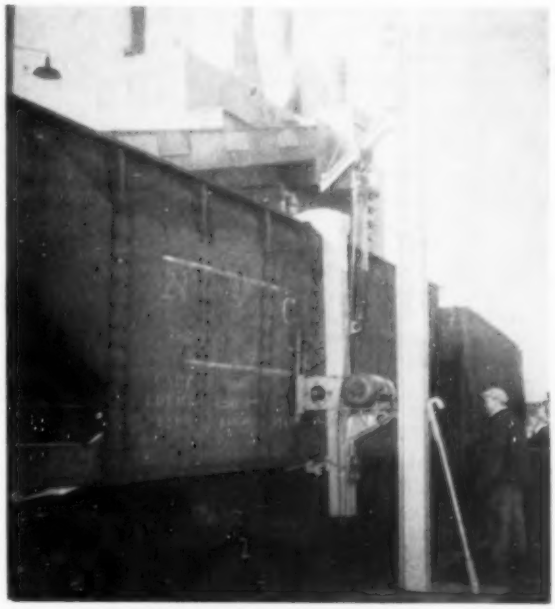
Tests to prove graduates' competence are conducted by authorities external to the school, through comprehensive examinations without which no diploma or degree is granted.

The method is simple. Combine the European educational system with adequate funds, and motivate children by offering the *highest material rewards for hard mental study* and you can get the same result anywhere in the world.

The greatest obstacle to a renovation of our education comes from one fact. Control, financing, and direction of education in the U. S. is in the hands of many thousands of local school boards, whose members seldom qualify as educational experts. State control is slight and federal assistance is rejected. We therefore are at an impassé.

It is exceedingly difficult and time-consuming to convince thousands of school boards that they must change the curriculum of the local high school; to persuade 48 states that their colleges and universities ought to confine themselves to education and not to vocational training and service activities. These have no place in institutions of higher learning.

In our own country, the schools have been primarily engines for Americanizing children of diverse back-



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Write today for the complete story including detailed catalog
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WORLD'S LARGEST-SELLING DIRECT-FIRED
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Ventilate CONFINED Places with Vano Design "C" Ventilator-Exhauster
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Other types are also available for supplying fresh air to men working in confined places, such as tanks, manholes, drums, boilers and shipholds.
For full details on Coppus Vano Design "C" Ventilator-Exhauster write COPPUS ENGINEERING CORPORATION, 185 Park Ave. Worcester 2, Mass.
WELDING FUMES are here removed by this Vano Ventilator-Exhauster.
FUMES FROM A REACTOR KETTLE are here withdrawn by tripod-mounted Vano Ventilator-Exhauster. Note non-collapsible suction tubing and discharge tubing.
ANOTHER COPPUS "BLUE RIBBON" PRODUCT

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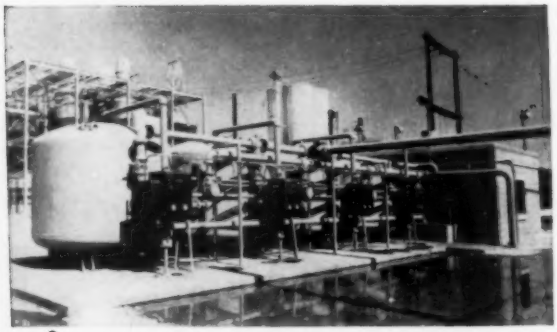

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Circle 1647 opposite last page

grounds. The schools teach all children to get along with others whose economic and cultural standards might be different. Our schools develop qualities needed by citizens in a democracy to carry out their political responsibilities. Our schools have accomplished these tasks excellently.

As long as the country devoted all its engeries singlemindedly to developing the highest standard of living for the greatest number of people, the kind of education received by American youngsters was entirely adequate. But in pursuit of this aim, we have neglected two things.

First, we have not counted the cost of our high standard of living in terms of rapid exhaustion of irreplaceable mineral and fuel resources.

Second, we have failed to recognize the damage done to our talented children by squeezing them into the strait jacket of the comprehensive school.

We must devise better ways to educate our talented youth. We cannot spare a single child who has the capacity to become a professional. In science and engineering we need many more trained people to help us develop substitutes for diminishing natural resources and to keep us ever advancing technologically. ◆

Underrating Structures

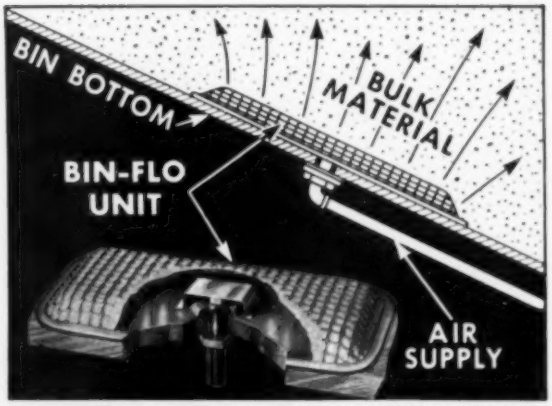
continued from page 17

struction materials, etc.

A number of factors must be considered in carrying out the analyses. Limitations may exist not only on strength, but also on deflections.

It has been found useful to carry out a refined analysis of the type available to the structural engineer, which can be used for design. Not only are these procedures conservative, but they also can be carried out within a reasonable time.

To check on this method, and to obtain additional feeling for the structural action, it has been found useful to carry out an ultimate load analysis. **continued on page 36**



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THERMODYNAMICS BASICS

By JOHN F. LEE

Professor of Mechanical Engineering, North Carolina State College

50 pages

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Handy, pocket-size booklet is a condensed reference containing basic, useful information on the field of thermodynamics. Material is taken from seven separate issues of POWER INDUSTRY. It covers all phases of thermodynamics from basic laws to computing steam power plant heat balances. This booklet will give you a solid foundation in the laws of thermodynamics plus specific examples on how to apply them to particular problems.

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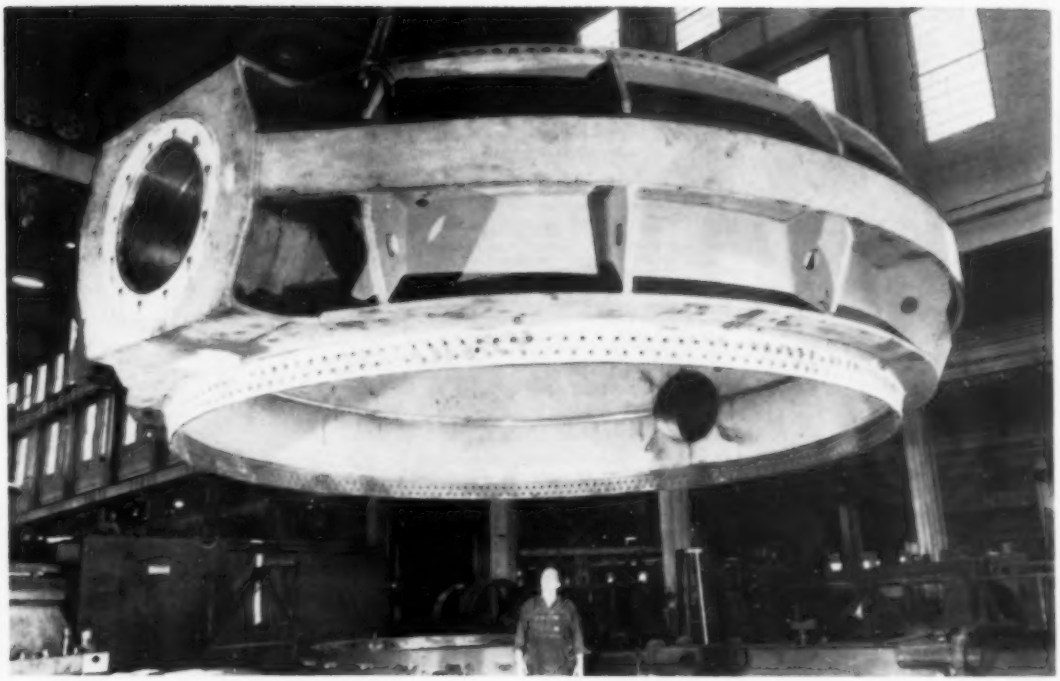

One of the largest hydraulic turbine butterfly valves ever built by Allis-Chalmers is now being installed on the downstream face of the dam at the Merwin plant of Pacific Power & Light Company. Valve is 17-ft dia, weighs 44 tons. A 120-rpm Francis-type hydraulic turbine capable of producing 68,000 horsepower at 190-ft head has also been shipped by A-C.

When a 30-hp boiler was needed fast for a new plant in Bogota, Colombia, it was shipped by air transport. The 3500-lb, 100-psig Orr & Sembower Powermaster package boiler was delivered just 24 hours after loading on the plane in Florida. Shipping by boat and overland by truck would have taken five weeks.

Boiler was unusual in that control cabinet and feed, blowdown and fuel connections were on left side and rear cover davit arm was on right side because of cramped installation site. Altitude of site is 9000 ft above sea level.

Twenty-five years ago, Philip Sporn, then chief engineer of American Gas and Electric Company, asked General Electric to design a voltage regulator with a load tap changer driven by a motor and controlled by a device to sense line voltage variations.

Raymond W. Smith, general manager of the Transformer Division of General Electric Company looks on as Mr. Sporn, now president of A. G. & E., cuts cake at recent celebration.

Transformer terminal connectors, built by Burndy Corporation for Texas Power & Light Co.'s new Stryker Creek plant. Note how angle plates are used instead of conventional castings to save about 100 lbs per connector. Lighter weight cuts material, manufacturing, and handling costs besides making aluminum-to-copper connectors easier to install.

World's largest gear-type spindle couplings, designed and built by Metal Products Div. of Koppers Company, Inc., are integral parts of new 32-in. rolling mill recently put into operation by Latrobe Steel Company at Latrobe, Pa. Each of two spindle couplings weighs nearly 5 tons, is 10 ft long and over 14 in. dia. Special curved faces on hub teeth allow large misalignment with minimum backlash.

Underrating Structures continued from page 34

This provides some indication of the reserve strength under the currently permitted loads, as well as those being considered. In addition, deflections, shears, etc., must be considered for the planned loading.

The possible value of carrying out such an analysis can be demonstrated by an example.

Three adjacent buildings in one plant were evaluated. A proposed operational change required that the first floors of each building be interconnected. To make the proposed operation feasible, it was necessary to handle storage equivalent to a uniform load of 380 psf and fork lift trucks of one ton capacity.

The problem was, could the present buildings support these loads? If not, what alterations could be made in the existing structures?

The first step brought to light construction drawings, construction data, a verbal history of plant construction, as well as observations made during the field inspection.

Analyses for this study were limited to the concrete slabs and supporting steel beams and girders. By applying refined design analyses, allowable loads for each of the structures were computed.

With the exception of the passageway in one building, there was no doubt about the ability of the buildings to carry both the uniform load and that due to the fork lift truck.

Recommendations were that four beams be added to increase the load capacity of the passageway. With this alteration, the existing buildings were capable of supporting the loads.

This study resulted in using the buildings for the increased loads with only minor alterations. It offers an excellent example of the extra strength that may be available. Additional work was not justified, since the solution at this point was satisfactory to the owner.

The allowable loads, as computed, might have been increased by even more refined analysis or by the third step.

Third step in the approach makes use of load tests to determine permissable loads. Testing procedures to be considered differ from the normally conducted proof load tests.

The procedure makes use of deflection and strain measurements under loads. This procedure offers a number of advantages:

- Information relating to the loads is obtained directly
- Variations of the materials from the ideal are taken into account. This includes variations of strengths due to rotting, rusting, etc., as well as strength in excess of that assumed
- Dynamic loads can be handled directly without introducing dynamic load factors of unknown accuracy
- The interaction of structural components is determined.

With this type of testing procedure, the basis for the acceptability of the test load is the comparison of stresses determined from the test. Also, allowable stresses specified by the appropriate code must be included. Critical deflections may be measured directly.

Exact procedure for setting up such a load test depends upon the particular structure.

One application of this procedure was made for a timber warehouse. The owner was interested in using larger fork lift trucks to expedite material handling procedures.

The bay which was expected to be weakest was selected for testing. We assumed that any load supported by this bay could be placed any place on the floor system. Deflection and strain measurements were taken at a number of points in the test bay.

Strain and deflection gages were located on the bottom of joists and girders so as to give optimum data. Electric resistance gages were used to measure strain, and the values were read on Baldwin Strain Indicators. Dial-type deflection gages were used, and readings were made directly

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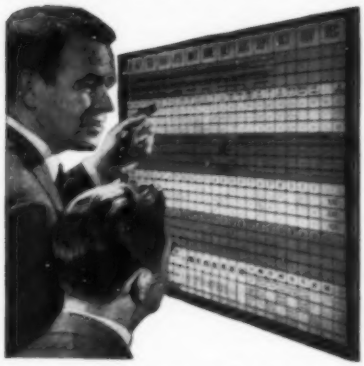

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- for more information on articles in this issue
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from the dials.

Timber properties were determined in two ways — from calculations based on test measurements, and from laboratory tests using samples from structural members in the test panel.

Test was conducted by placing loads at critical locations within the test bay. Strains and deflections were read under the floor system for each loading condition.

In addition, strains and deflections due to dynamic loading, caused by movements of the loaded fork lift truck, were measured. Test data were such that structural action within the test bay could be completely determined.

Results of this test indicated that larger fork lift trucks could be used safely. Annual savings to the owner were estimated to be several times the investigation cost. Without the test procedure, there was no way to justify permitting the loads involved with the heavier equipment.

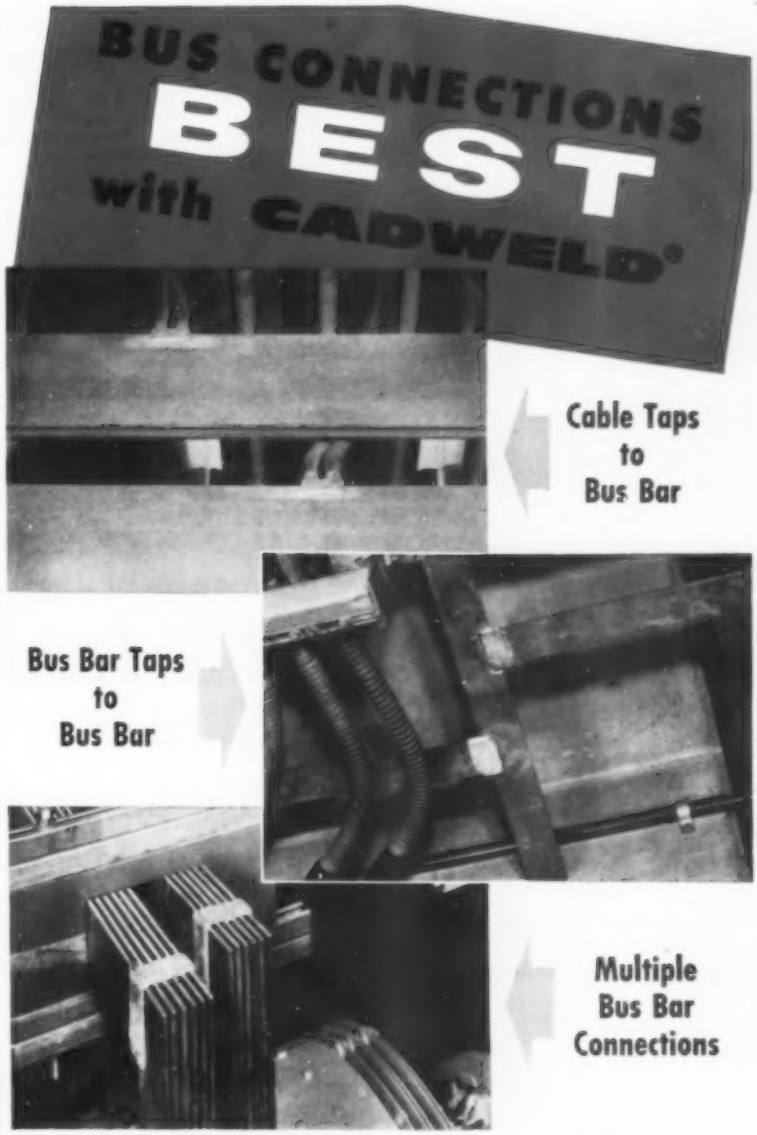
In making an analysis of the floor system, it was obvious that there was additional strength. But, there was no way of determining this until test results were available.

Observations based on this test demonstrate the information that such a procedure can furnish. Normal design assumptions require that 100% of a concentrated load be taken by an individual joist. For the floor system tested, the maximum load in a single joist was found to be 43% of the concentrated load.

For timber construction design, pinned end conditions for the joist and girders must be assumed. The test indicated that end fixity of girders and joists was 34% and 43% compared with a fixed-end beam.

These values will, of course, vary from structure to structure. They could be introduced into design only if test results are available for the particular structure.

This procedure for evaluating existing structures, has been found to be generally applicable. For many structures, this procedure can provide information that permits increasing allowable loads. The investment to determine this information accurately is small, compared with the possible savings. ◆



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90% of the possible connections are standard and the remaining 10% (specials) can be handled in record time.

The finished CADWELD connection is more compact than any mechanical connection on the market.

CADWELD Electrical Connections have attained their high rating from Engineers and Contractors for their reliability. There is no maintenance on a CADWELD Connection.

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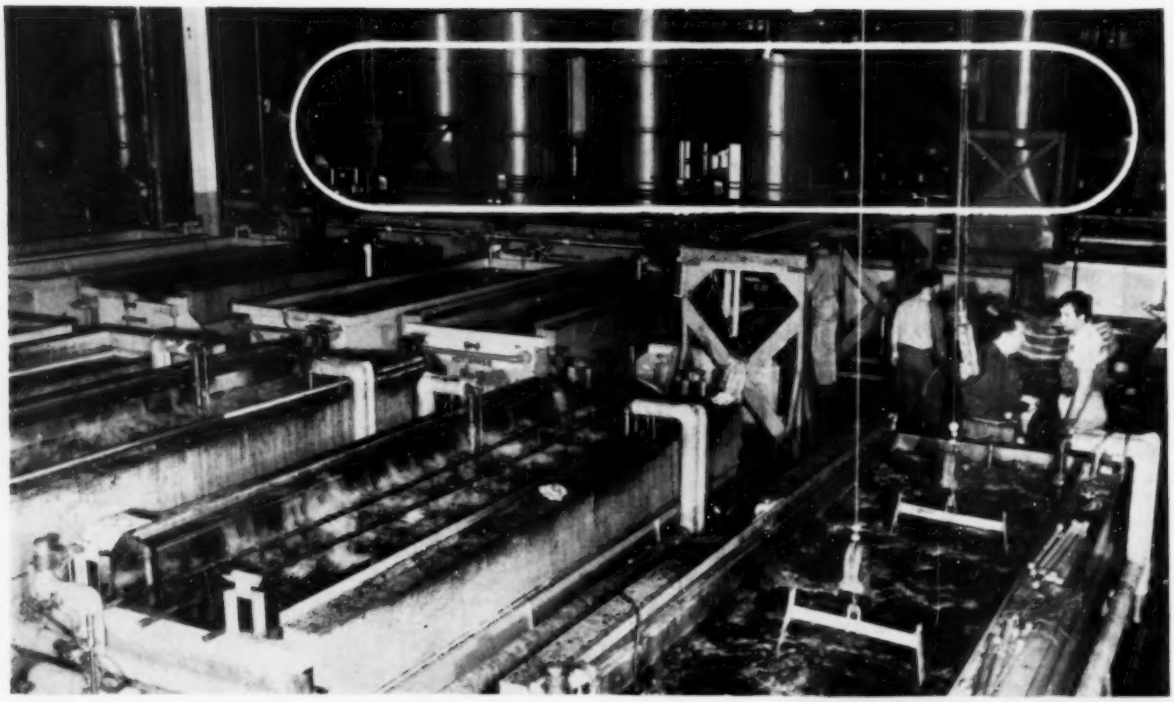

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Efficient Plating Tank Exhaust with No Overhead Obstruction

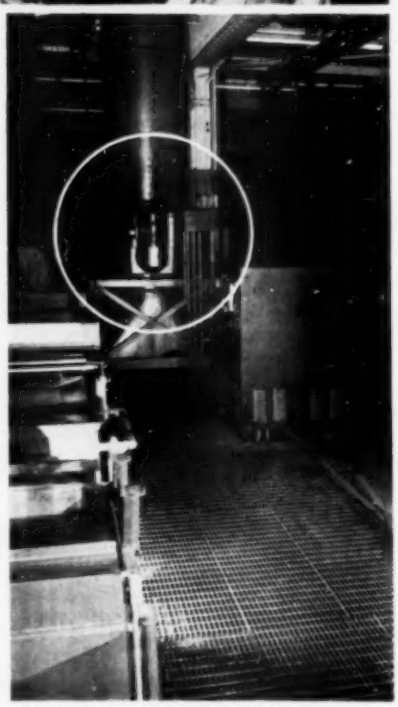
Hartzell High-Temperature Vaneaxial Blowers power this unique plating tank exhaust system at the Stratford, Connecticut plant of Sikorsky Aircraft Division, United Aircraft Corporation.

Use of the lateral slots and sub-floor ducts keeps aisles clear . . . and no part of the exhaust system extends above the tanks to hamper use of cranes in loading and unloading the tanks.

Exhaust of 200 CFM per square foot of tank area is provided with all blowers operating at approximately 2½" WG. Fumes are exhausted vertically through the roof.

Hartzell has the equipment that is just right for almost any industrial air moving job. See your nearby Hartzell field engineer for the details of how Hartzell can solve *your* tough air moving problem.

This installation was handled by the Hartzell field office at 1243 Post Road; Fairfield, Connecticut; phone Clearwater 9-3349.



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Hartzell fans and blowers are engineered and built for the exacting requirements of tough industrial service. There's no compromise with quality for the sake of shaving a few dollars on price. Hartzell fans are designed for the industrial buyer who is willing to pay for long life, dependable service and low maintenance.

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PROPELLER FAN CO.
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ENGINEERING OFFICES IN PRINCIPAL CITIES

Circle 1651 opposite last page

Hiring Engineers

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— and at least one of his future co-workers.

With plant engineering personnel, a tour through the plant is a must. During the tour, the applicant's reaction to the plant can tell volumes about his experience and how he will tackle and solve problems. Further discussion after the tour is almost as enlightening.

Fix the Salary

Financial aspects of the job should be discussed candidly and specific guarantees given verbally should be confirmed in writing. Having a standard salary schedule showing minimum, maximum, and specific intermediate salary levels is a great help. The man then can see exactly what will happen if he performs satisfactorily.

A final consideration for both the prospective engineer and the company is the man's professional development. The Position Description can serve as the start of this discussion. Most engineers, however, will want to discuss this aspect of the job in detail — exploring promotional prospects and promotion channels, company training programs, and evening educational opportunities.

It is advisable to have local college catalogues and brochures available describing company educational subsidy plans. If you have no local colleges, you can get a list of available correspondence college credit courses and participating universities and colleges from the National University Extension Association, Bloomington, Ind.

See It His Way

Promotional prospects and channels of promotion are usually the most important items to be discussed in relation to professional development. Preferably one of the applicant's future superiors should cover these by relating promotional channels to organization charts and by giving specific past examples of promotions.

The prospective engineer normally is vitally interested in his future professional development — don't hurry over this vital subject. ◆

SPOTLIGHT ON . . .

GROWTH

expansions

Burgess-Manning Co.'s Industrial Silencer Division, Dallas, Texas, is moving to larger quarters. New facilities include air-conditioned development laboratory for studying field problems on noise, flow of gas in pipes, and liquid separation.

Combustion Engineering, Inc. now offers to industry a radiological health and safety consulting service at its Windsor, Conn., **Nuclear Division.** Service is available to handlers and users of radio-active materials who do not have facilities or trained staff to adequately monitor their own operations.

A. W. Cash Co., Decatur, Ill., acquires new building to house its offices. Former office space in plant will house additional manufacturing facilities.

mergers

Engelhard Industries, Inc. — a consolidation of nine American companies in the precious metals and precision manufacturing fields — begins business at Plainville, Mass. with annual sales estimated at over $2 million. Corporation will supply atomic reactor components, nuclear instruments, air craft and missile parts, equipment for petroleum, chemical, plastics, automotive, and electrical industries.

Charles W. Engelhard is board chairman; Gordon V. Richdale is president. Member firms include **Baker & Co., Inc., Irvington Smelting & Refining Works, D. E. Makepeace Co., National Electric Instrument Co., The H. A. Wilson Co.** Corporation controls three additional U. S. companies and 12 foreign corporations. ◆

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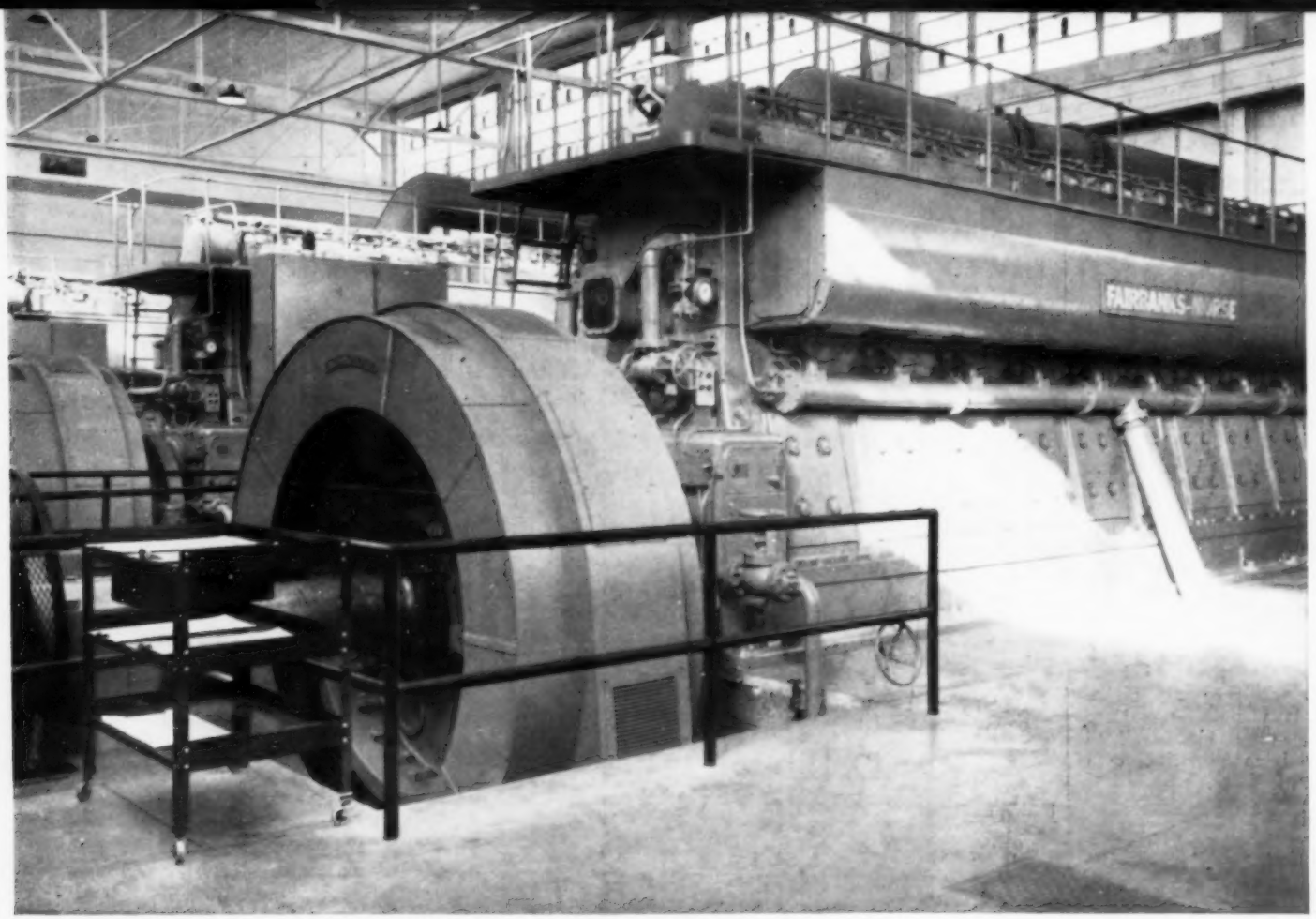

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